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EMERGENCY PLAN FOR SANDY LAKE DAM AND RESERVOIR

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19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

This plan implements the Corps program to prepare emergency plans for all Corps dams. It provides a guide for actions to identify and mitigate or respond to various types of emergencies which, while rare, could occur in the operation of Sandy Lake Dam.

→ to p. i

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CENCS-ED-M(11-2-240A)	Emergency Action Plan Sandy Lake Dam

TO	FROM	DATE	CMT 1
See Attached Distribution	CENCS-ED-M	15 April 1988 Blackstone/429	

Copies of the completed emergency plans for Sandy Lake Dam is enclosed for your reference. This report implements the Corps program to prepare emergency plans for all Corps dams. It provides a guide for identifying, mitigating, or responding to various types of emergencies which, although unlikely, could occur during the operation of the dam.

Please contact me at (612) 220-0429 with questions or comments or to request additional copies.

1 Encl

JOHN F. BLACKSTONE
Project Manager

EMERGENCY PLAN DISTRIBUTION

Sandy Lake Dam

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Dated
18 April 1988

DEPARTMENT OF THE ARMY
NORTH CENTRAL DIVISION, CORPS OF ENGINEERS
536 SOUTH CLARK STREET
CHICAGO, ILLINOIS 60605-1592

REPLY TO
ATTENTION OF

28 JAN 1988

CENCD-ED-WH (1130-2-419)

MEMORANDUM FOR: Commander, St. Paul District, ATTN: CENCS-ED-M

SUBJECT: Emergency Plans for Gull Lake Dam, Sandy Lake Dam, Pokegama Dam and Leech Lake Dam

1. We have reviewed the emergency plans for the subject dams. The plans are approved subject to preparation of revised pages which address the following comments.

a. Provide a revised contact list internal to the Corps of Engineers. The contact list should include the position of each person to be contacted.

b. Provide a list of the equipment and materials which are available at each site for use in an emergency.

c. Revise the plates which present the downstream profiles resulting from dam failure to include the profile for the flood of record and for failure during normal full pool.

2. References:

a. CENCS-ED-M Memorandum of 18 September 1987, subject: Emergency Plans for Gull Lake Dam and Reservoir and Sandy Lake Dam and Reservoir.

b. CENCS-ED-M Memorandum of 18 June 1987, subject: Emergency Plans for Pokegama Dam and Reservoir and Leech Lake Dam and Reservoir.

FOR THE COMMANDER:

ZANE M. GOODWIN, P.E.
Chief, Engineering Division

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1135 U.S. POST OFFICE & CUSTOM HOUSE
ST. PAUL, MINNESOTA 55101-1479

REPLY TO
ATTENTION OF
CENCS-ED-M (350-3-2A)

18 SEP 1987

SUBJECT: Emergency Plans for Gull Lake Dam and Reservoir and Sandy Lake Dam and Reservoir

MEMORANDUM FOR: Commander, North Central Division, 536 South Clark Street, Chicago, Illinois 60605-1592

1. Subject reports are submitted in accordance with Engineer Regulation 1130-2-419 for approval.

2. These reports implement the Corps program to prepare emergency plans for all Corps dams. It provides a guide for identifying, mitigating, or responding to various types of emergencies, which, although unlikely, could occur during the operation of Gull and Sandy Lakes.

3. Please note that we have enclosed preliminary copies of the final emergency action plans because we are awaiting plan approval before printing copies for distribution. We request that you return the enclosed plans, and we will provide copies of the final plans after they have been approved and printed.

4. If you have questions on this matter, please contact John Blackstone (FTS 725-5949).

FOR THE COMMANDER:

Robert F. Post

ROBERT F. POST
Chief, Engineering Division

2 Encls
1. EAP, Gull Lake
2. EAP, Sandy Lake

(4)

EMERGENCY PLAN

FOR

SANDY LAKE DAM AND RESERVOIR

PREPARED BY THE

ST. PAUL DISTRICT

U.S. ARMY CORPS OF ENGINEERS

JUNE 1987

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EMERGENCY PLAN
FOR
SANDY LAKE DAM AND RESERVOIR

1. Introduction

Part of the land surrounding Sandy Lake Dam and Reservoir that would be inundated by the Probable Maximum Flood is not in Federal ownership. In addition, most of the land under Federal control is also public use land. The possibility therefore exists that high water levels could cause a hazard to life and property in the project area and surrounding lands. In addition, a failure of the dam or embankment during normal pool, low flow conditions could result in the sudden release of a large volume of water from the reservoir, which would cause a hazard to life and property in the project area and surrounding lands.

a. Purpose

This plan implements the Corps program to prepare emergency plans for all Corps dams. It provides a guide for actions to identify and mitigate or respond to various types of emergencies which, while rare, could occur in the operation of Sandy Lake Dam. Specific information on emergency actions to be taken is provided in the following appendices:

(1) APPENDIX A, Emergency Identification Subplan.

(2) APPENDIX B, Emergency Operations and Repair Subplan.

(3) APPENDIX C, Emergency Notification Subplan.

(4) APPENDIX D, Inundation Map Package.

b. Applicability

The emergency plan is applicable to all Corps elements and field offices concerned with operation of Sandy Lake Dam.

c. References

(1) Flood Emergency Plans, Guidelines for Corps Dams, Hydrologic Engineering Center, Water Resources Support Center, Davis, CA, June 1980.

(2) Federal Guidelines for Dam Safety, Prepared by Ad Hoc Interagency Committee on Dam Safety of the Federal Coordinating Council for Science, Engineering and Technology, Washington, DC, 25 June 1979.

(3) Emergency Plan for Winnibigoshish Dam and Reservoir, U.S. Army Corps of Engineers, St. Paul District, October 1985.

(4) Emergency Plan for Lock and Dam No. 10, Near Guttenburg, Iowa, U.S. Army Corps of Engineers, St. Paul District, May 1985.

(5) Mississippi River Headwaters Lakes in Minnesota, Feasibility Study: Main Report, U.S. Army Corps of Engineers, St. Paul District, September 1982.

(6) ER 1130-2-417, Major Rehabilitation Program and Dam Safety Assurance Program, U.S. Army Corps of Engineers, revised edition, 1980.

(7) ER 1130-2-419, Dam Operations Management Policy, U.S. Army Corps of Engineers, 18 May 1979.

(8) ER 1130-2-419, Change 1 Project Operation: Dam Operation Management Policy, U.S. Army Corps of Engineers, 9 April 1982.

(9) Flood Hydrograph Package, HEC-1, U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, CA, September 1981.

(10) Research Document No. 19, Example Emergency Plan for Blue Marsh Dam and Lake, U.S. Army Corps of Engineers, St. Paul District, August 1983.

(11) Master Reservoir Regulation Manual, Navigation and Flood Control, Mississippi River Headwaters Reservoirs, Minnesota, St. Paul District, Corps of Engineers, April 1963.

(12) Mississippi River Headwaters Reservoirs, Master Plan for Public Use Development and Resource Management, St. Paul District, U.S. Army Corps of Engineers, August 1977.

(13) Earth Manual, Second Edition, U.S. Department of the Interior, Water and Power Resources Service Reprint.

(14) Lambe, T. William and Robert V. Whitman, 1969, Soil Mechanics, John Wiley & Sons, New York.

(15) Structural Stability Evaluation, Sandy Lake Dam, C.E. Pace, Structures Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., Aug. 1981.

d. Scope

This plan addresses emergencies related to above normal reservoir water levels and/or rapid release of large volumes of water past the dam. The plan covers identification of impending or existing emergencies, notification of other parties concerning impending or existing emergencies, and emergency operations and repairs. Areas potentially affected by emergencies are identified for the cases of Probable Maximum Flood without dam failure; Probable Maximum Flood with dam failure; and dam failure at normal high pool level (top of flood control pool).

e. Definitions

(1) Pre-emergency

A "pre-emergency" condition is one in which some impending or existing threat to the safe operation of the dam and reservoir is recognized but no significant hazard to life or property is expected to occur. Notification of other Corps offices is required upon declaration of a pre-emergency condition.

(2) Emergency

An "emergency" condition is one in which the occurrence of a significant hazard to life or property is possible or certain to occur. Conditions justifying declaration of an emergency condition may be imminent. such as breach of the dam or uncontrollable piping; or longer term, such as predicted large inflows. Warnings to evacuate are required upon declaration of an emergency condition.

2. Description of Project Area

a. Location

Sandy Lake Reservoir is one of six Mississippi Headwaters Reservoirs located in north central Minnesota. Sandy Lake Dam and Reservoir are located in Aitkin County near the village of Libby, Minnesota. The dam is on the Sandy River, 1.3 river miles upstream of the confluence of the Sandy and Mississippi Rivers, and 1106.9 river miles above the mouth of the Ohio River. It is 264.2 river miles above St. Paul, Minnesota, 50.2 river miles above Aitkin, Minnesota and 77.7 river miles below Pokegama Dam. The Basin Map and Location Map are shown on Plates 1 and 2.

b. Topography

The total area of the Sandy Lake watershed is 421 square miles. Elevations range from 1575 feet in the extreme eastern portion of the watershed to 1217 feet at the Sandy Lake shoreline. Relief varies from 285 feet at the east watershed boundary in the Fond du Lac State Forest to 115 feet north of Sandy Lake.

c. Geology and Soils

The area surrounding Sandy Lake is primarily a glacial till plain with a large outwash area characterized by surface deposits of sand and gravel to the northwest. A 100-150 foot thick mantle of glacial drift covers the entire surface of Aitkin County, and overlies an older rock formation. Drainage of glacial lake Aitkin has left beach ridges and lacustrine deposits of silt and clay in the lowland area north of Aitkin, Minnesota. Extensive peat bogs cover approximately 40 percent of Aitkin County and average 5 feet in thickness. A large peat or muskeg

area extends over 75 to 100 square miles and is located north of Aitkin.

d. Climate

The climate of the headwaters area is characterized by long severe winters with snow on the ground from November to March. The mean annual snowfall is 58.9 inches, and the mean annual precipitation is 27.9 inches. Extreme temperatures range from 53 degrees Fahrenheit below zero to 104 degrees Fahrenheit above zero. Normally, the winter months, December through February, are the driest, while the greatest amount of precipitation occurs during June and July.

e. Principal Streams

The Sandy Lake basin extends eastward from the Mississippi River approximately 26 miles and is about 18 miles wide in the north-south direction. The watershed is drained by four main rivers; the West Savanna River from the north, the Prairie and Tamarack Rivers from the east and the Sandy River from the South. The Prairie River is the longest stream in the basin, it is approximately 30 miles from its origin at elevation 1315 to its mouth at Sandy Lake at elevation 1217. The average river slope is 3.3 feet per mile.

Sandy Lake is drained by Sandy River which joins the Mississippi River 1.3 miles downstream of the dam. During flood events, the backwater from the Mississippi River has a significant effect on the outflow from the Sandy Lake dam. In fact, the dam was built to withstand a reversal of head from the Mississippi River backing up the channel when the water level in Sandy Lake is below that in the river below the dam.

3. Description of Project Features

The Sandy Lake Project consists of Sandy Lake Reservoir, Sandy Lake Dam, four perimeter dikes, outlet works, public use areas and camping facilities. A plan view of the project is shown on Plate 3, and cross sections of the structure are shown on Plate 4.

a. Sandy Lake Dam

The earthen embankments at Sandy Lake Dam have timber diaphragm cores filled with puddled clay. The right and left portions of the embankment are 75 and 30 feet long with top elevations of 1225.31 and 1227.81 respectively.

b. Control Structure

The Sandy Lake Dam control structure is a gated, multi-bay, mass concrete structure supported on timber pilings. The elevation of the top of the concrete piers is 1221.31 feet. An 8.0 foot wide roadway with a

top elevation of 1223.5 feet is supported by the structure.

The control structure is 109 feet long between abutments and has 12 sluiceways with a net spillway length of 67 feet. Six 5.0-feet wide by 4-feet high sluice gates are controlled by steel slide gates. The sill elevation of the slide gate bays is 1207.31 feet. Small openings above each of the gated bays allow uncontrolled discharge to occur whenever the lake elevation is above 1218.31 feet. The log sluice at Sandy Lake Dam is 11 feet wide, has a sill elevation of 1207.31 feet, and is controlled by stop logs. The lock chamber has been divided into five 5.2-foot wide bays and closed with a concrete curtain wall. Above the top of the concrete wall (elevation 1216.81 feet) the bays are controlled by stop logs. The spillway rating curve for Sandy Lake Dam under high flow conditions in the Sandy River and in the Mississippi River is shown on Plate 5.

c. Reservoir

Sandy Lake Reservoir was constructed as part of a project to store water for improvement of navigation on the reach of the Mississippi River from St. Paul, Minnesota to Lake Pepin. The reservoir controls the runoff from a 421 square mile drainage area and encompasses several natural lakes including Sandy, Aitkin, Flowage, Davis, Round, Tieson, Sandy River and Rat Lakes.

Gage zero for Sandy Lake Reservoir is 1207.31. At the maximum operating pool elevation of 1218.31, the reservoir storage is 81,900 acre feet. During summer, the reservoir is maintained at elevation 1216.32 $\pm$ 0.2 feet and contains 62,400 acre-feet storage. Winter drawdown pool level is at elevation 1214.31, 7.0 feet above the outlet sill elevation, with 44,400 acre-feet of water in the pool.

d. Perimeter Dikes

There are four perimeter dikes located near the outlet of Sandy Lake. One dike is directly south and three are north of the dam. The dikes, located in low areas have a minimum top elevation of 1225.31 feet.

e. Public Use Areas

Public use areas associated with the Sandy Lake Dam and Recreation Area include campground facilities, picnic areas, boat launches, a swimming beach and parking facilities. The area which includes 120 acres of land is located on both the right and left banks of the dam along the Sandy River and Big Sandy Lake.

f. Instrumentation

The existing hydrologic network in the area of and adjacent to the entire headwaters drainage basin consists of 22 climatological, 31 discharge, and 20 snow survey stations. Within the Sandy Lake basin, there are climatological data stations at Wright, Minnesota and at the

Sandy Lake Dam. Pool elevation and tailwater elevation at the dam are monitored by recording water level gages. Streamflow between the Sandy River mouth and Aitkin, Minnesota is monitored by stream gaging stations located on the Willow River, and on the Mississippi River below Palisade and at Aitkin. The basin above Sandy Lake contains no stream gaging stations for regular reporting. Snow survey stations within the basin are located at Sandy Lake Dam, and near the towns of Tamarack, Hassman, and Cromwell, Minnesota.

g. Operations and Maintenance

Sandy Lake Dam and Reservoir is operated by the U. S. Army Corps of Engineers. A Park Manager resides at the dam to carry out operations and routine repairs. At the present time, the federal government holds fee title to 1,116 acres of land and flowage easements on another 9,785 acres around Sandy Lake. The St. Paul District Corps of Engineers owns 8,190 feet of shoreline and is also the owner, operator, and regulator of the Sandy Lake Dam and Reservoir. The National Weather Service does all hydrologic forecasts within the Upper Mississippi River Basin, and the U.S. Geological Survey collects data on the discharges at various stations within this basin.

4. Potentially Affected Project Areas

Emergencies at the Sandy Lake Dam and Reservoir could endanger the safety of people and property within the borders of the project. The principal areas of concern are the reservoir surface and the Sandy Lake Recreation Area.

a. Reservoir Surface

The reservoir surface is heavily used for swimming, fishing and boating. Sandy Lake Reservoir has a surface area of 9,400 acres at project pool elevation.

Dangers to those on the reservoir as the result of an emergency could include strong surface currents in the event of a dam break or flow over the spillway and high waves during storms. However, weather conditions usually accompanying large storms make recreation on the reservoir unlikely during such periods.

b. Sandy Lake Recreation Area

The Sandy Lake Dam and Recreation Area is located on the north shore of Sandy Lake. This area includes approximately 120 acres of land of which 85 acres has been developed for campground use. A portion of the area downstream of the dam is low, marshy, and subject to flooding. The 76 acres on the right bank is relatively level and includes an extensive amount of marshland which is not usable for conventional recreation. Most of the developed areas have a park-like appearance with mowed grass

and scattered trees being the only vegetation. The fringes of the developed areas are deciduous forest made up of oak, aspen, and birch, with relatively dense underbrush.

5. Potentially Affected Non-project Areas

Emergencies at Sandy Lake Dam and Reservoir could create a hazard to life and property on non-project lands including those in the vicinity of the reservoir, and along the Mississippi River below Libby, Minnesota.

a. Vicinity of Reservoir

Much of the land surrounding Sandy Lake Reservoir is private land and many cabins and residences have been built in the area. The potential for damage in the vicinity of Sandy Lake Reservoir due to a flood event is high.

b. Palisade, Minnesota

The town of Palisade, Minnesota, 19 miles downstream of Sandy Lake Dam, could experience flooding on the south and east areas of the town due to an emergency at Sandy Lake Dam. The Highway 65 bridge directly downstream of Sandy Lake dam would most likely be destroyed by a flood event. Highway 232 and 169 bridges, 21 and 38 miles downstream of the dam might also be destroyed or damaged due to an emergency situation at Sandy Lake Dam.

6. Potential Causes of an Emergency

The potential causes of an emergency affecting the operation or safety of Sandy Lake Dam and Reservoir which were selected for planning include:

a. Excessive Seepage

b. Sabotage

c. Extreme Storm

d. Slope Failure

e. Foundation Failure

Each of the above items is discussed briefly in the following paragraphs.

a. Excessive Seepage

A potential exists for seepage through, around, or under the dam. Some seepage is normal and is not considered hazardous. However, seepage that increases in amount or contains suspended solids may indicate piping which can lead to breach of the dam. Seepage problems are potentially controllable depending on their severity, location and other circumstances.

b. Sabotage

A potential exists that operation of the dam could be affected by sabotage disrupting communications, disabling gate controls or equipment, breaching the dam or various combinations of the foregoing. Only a breach of the dam, for instance by use of explosives, would cause sudden release of a dangerous volume of water.

c. Extreme Storm

An extreme storm could occur in the area of the reservoir or over the watershed upstream of the reservoir resulting in large inflows to the reservoir. Such a storm would cause high reservoir level, large discharges over the spillway, and/or high waves on the reservoir surface. The potential for mitigating such problems depends on their severity and other circumstances.

d. Slope Failure

A sliding or sloughing of the dam face could occur. A slope failure that extended to the top of the embankment would effectively lower the crest. This could result in sudden release of a large volume of water if the reservoir water surface exceeded the elevation of the resulting dam crest. The potential for control of slope failure problems depends on their magnitude, severity, reservoir water surface elevation and other circumstances.

e. Foundation Failure

Failure of the foundation underlying either the concrete control structure or the earth embankment dam could occur. This could result in breaching of the dam and control structure, allowing sudden release of a large volume of water. The potential for control of foundation failure problems depends on their magnitude, severity, reservoir water surface elevations and other circumstances. Continued siltation at the upstream toe of the dam and spillway also contributes to excess foundation pressure, which can cause failure.

7. Computation of Outflow Hydrographs

Outflow Hydrographs were computed for the hypothetical cases of Probable Maximum Flood without and with failure and failure at normal high pool elevation. Outflow hydrographs were computed for the threshold flood, 40% PMF and 70% PMF for with and without failure conditions. The threshold flood is the flood which fully uses the capacity of the reservoir and allows adequate freeboard at the dam. The threshold flood is equivalent to 10% of the PMF. These nine conditions encompass the types of situations potentially resulting from the causes of failures described in Paragraph 6.

a. Computational Procedures

All outflow hydrographs were computed using the dam break component of the U.S. Army Corps of Engineers' HEC-1 model. Table 1 describes the principal parameters of the respective computations for the three cases investigated.

b. Inflow, Outflow, and Reservoir Stage Hydrographs

The inflow, outflow, and reservoir stage hydrographs for Sandy Lake Dam computed for the emergency situations of PMF without and with failure and failure at normal high pool elevations are shown on Plates 6, 7, and 8, respectively.

c. Maximum Pool Elevations

The computed maximum pool elevations due to the Probable Maximum Flood (PMF) without and with dam failure are 1228.7 and 1228.6 respectively. The starting pool elevation for the routing of a failure at normal high pool elevation is 1218.3. The computed maximum pool elevations given respectively without and with dam failure for the 70% PMF are 1226.9 and 1226.8, the 40% PMF elevations are 1224.5 and 1224.1 and the Threshold Flood elevations are 1219.3 and 1219.7. In the case of the Threshold flood with failure, the slide gates were assumed to become inoperable, preventing increased discharge and causing the water level to rise. Breach was assumed to occur when the reservoir reached maximum elevation due to the Threshold flood inflow.

d. Comparison of Computed Peak Outflows

The adopted Probable Maximum Flood has a peak inflow of 40,500 cfs. The computed maximum peak outflow for the case of Probable Maximum Flood with failure is 19,300 cfs. Plate 9 shows this outflow in comparison to outflows from known dam failures. The hydraulic depth of Sandy Lake Dam from Probable Maximum Flood level to invert of outlet is approximately 21 feet. The value of the envelope curve shown in Plate 9 for hydraulic depth of 21 feet is approximately 18,000 cfs which is 1,300 cfs less than the maximum outflow computed for Sandy Lake Dam. This difference is approximately 7 percent of the computed maximum outflow.

Several failure scenarios for Sandy Lake Dam were studied. The case of failure concurrent with a Probable Maximum Flood represents a compounding of extremely unlikely events. The case of failure at normal high pool elevation represents much less severe conditions that might occur under normal non-flood conditions. It is doubtful that the historical failure data (Plate 9) contains events of the magnitude of a Probable Maximum Flood. The envelope curve on that figure lies somewhere between failure at normal high pool elevation and failure at the Probable Maximum Flood peak. For this reason, the computed result for the Probable Maximum Flood with failure lies outside the historical envelope curve.

8. Routing of Outflow Hydrographs

Computed maximum flood elevations and the times for occurrence for the nine cases considered at each cross section between the dam and the downstream routing limit are listed in Tables 2A-2D. Crest profiles of the channel downstream of the dam for the nine conditions are shown on Plates 10 and 11. Plates D-6, D-7, and D-8 show the approximate stage hydrographs at selected downstream cross sections for each condition. Hazardous conditions exist when: (1) floodwater depths are in excess of two feet, (2) floodwater velocities exceed four feet per second, (3) floodwater depths are of sufficient elevation to damage property.

9. Inundation Maps

An inundation map package is included in Appendix D to this document. The boundaries of the areas expected to be inundated by the hypothesized conditions of Probable Maximum Flood without failure and Probable Maximum Flood with failure are shown on Plates D-2 through D-5.

10. Affected Areas

The areas affected for the conditions of Probable Maximum Flood without failure and Probable Maximum Flood with failure are indicated on Plates D-2 through D-5. Unless otherwise noted, affected areas outside the inundation boundary are potentially subject to isolation, in most cases by flooding of roads serving the area. Notes on the plates indicate any areas outside the inundation boundary potentially affected by the secondary problems which might stem from inundation. Table 3 lists the potential secondary problems noted on each plate.

11. Identification of Needed Evacuation Planning

a. Jurisdictions Affected

The area affected in the maximum case of Probable Maximum Flood with

failure encompasses parts or all of the following jurisdictions:

(1) Libby, Minnesota

(2) Palisade, Minnesota

b. Evacuation Plans

Plans pertinent to the dissemination of flood warnings and evacuation in the portions of the jurisdictions which would be affected in the case of the Probable Maximum Flood with/without failure or a failure at normal pool should incorporate the information presented in this report into all existing and future plans. A copy of this report is to be provided to the appropriate emergency personnel for each of the affected communities.

c. Evaluation of Evacuation Plans

Principal characteristics of evacuation plans which affect their potential for successful evacuation are shown in Table 4.

d. Evacuation Planning

Evacuation plans are to be developed thorough local coordination with the affected communities. Information on evacuation planning and examples of evacuation plans are available from the Corps of Engineers. See Appendix D of this report for probable areas of evacuation.

TABLE I: SANDY DAM

INFORMATION ON COMPUTATION OF OUTFLOW HYDROGRAPHS

Condition	Probable Maximum Flood (PMF)	Probable Max. Flood (PMF) with Failure	Failure at Normal High Pool Elevation	Threshold Flood Without Failure	Threshold Flood With Failure	70% PMF Without Failure	70%PMF With Failure	40%PMF Without Failure	40%PMF With Failure
Initial Pool Elevation (ft)	1217.0	1217.0	1218.3	1217.0	1217.0	1217.0	1217.0	1217.0	1217.0
Inflow Hydrograph	40,500	40,500	100	4000	4000	28,300	28,300	16,200	16,200
Breach Type	NA	OVERTOPPING	PIPING	NA	PIPING	NA	OVERTOPPING	NA	OVERTOPPING
Pool Elevation when Failure begins (ft)	NA	1221.3	1218.3	NA	1219.7	NA	1221.3	NA	1221.3
Maximum Pool Elevation (ft)	1228.7	1228.6	1218.3	1219.3	1219.7	1226.9	1226.8	1224.5	1224.1
Maximum Release Rate (cfs)	20,300	20,000	1500	1000	1500	10,300	10,700	4200	5000
Ultimate Bottom Width of Breach (ft)	NA	35	40	NA	35	NA	35	NA	35
Ultimate Bottom Elevation of Breach (ft)	NA	1211.3	1213.3	NA	1211.3	NA	1211.3	NA	1211.3
Side Slope of Breach (units horizontal to 1 unit vertical)	NA	0	0	NA	0	NA	0	NA	0
Time for Breach to Develop (hrs)	NA	3.0	3.0	NA	3.0	NA	3.0	NA	3.0

TABLE 2A

COMPUTED ELEVATIONS AND TIMES OF ARRIVAL FOR FLOOD WAVE
SANDY LAKE DAM AND RESERVOIR

Section	Dist. Below Dam (mi.)	Probable Maximum Flood Without Failure: Max. Elev. (ft.)	Probable Maximum Flood Without Failure: Time of Max. Elev. (hr.)1/	Probable Maximum Flood With Failure: Max. Elev. (ft.)	Probable Maximum Flood With Failure: Time of Max. Elev. (hr.)2/	Failure at Normal High Pool Elevation: Max. Elev. (ft)	Failure at Normal High Pool Elevation: Time of Max. Elev. (hr.)2/
1	0.4	1228.3	105	1228.3	81	1214.6	15
2	1.9	1227.6	105	1227.5	81	1213.7	24
3	3.6	1225.7	117	1225.6	93	1212.0	60
4	7.9	1224.8	141	1224.8	117	1210.9	90
5	11.1	1224.0	150	1224.0	126	1207.8	93
6	15.0	1223.9	171	1223.9	150	1206.9	102
7	19.1	1223.9	177	1223.9	153	1204.0	102
8	21.1	1223.5	177	1223.5	153	1202.5	102
9	21.7	1222.3	192	1222.3	171	1201.3	108
10	24.1	1220.5	201	1220.6	177	1201.0	111
11	28.6	1216.5	237	1216.5	213	1199.8	123
12	36.7	1213.9	276	1213.9	252	1196.4	144
13	43.6	1210.0	327	1210.0	303	1194.1	153

1/ Measured from time reservoir level exceeds the maximum operating limit.

2/ Measured from the beginning of failure.

TABLE 2B

COMPUTED ELEVATIONS AND TIMES OF ARRIVAL FOR FLOOD WAVE
SANDY LAKE DAM AND RESERVOIR

Section	Dist. Below Dam (mi.)	70% PMF Without Failure Max. Elev. (ft.)	70% PMF Without Failure Time of Max. Elev. (hr.)1/	70% PMF With Failure Max. Elev. (ft.)	70% PMF With Failure Time of Max. Elev. (hr.)2/
1	0.4	1226.4	138	1226.4	90
2	1.0	1225.3	138	1225.5	90
3	3.6	1223.6	138	1223.8	108
4	7.9	1221.5	165	1221.6	135
5	11.1	1220.7	174	1220.9	144
6	15.0	1220.3	195	1220.5	165
7	19.1	1219.7	198	1219.9	168
8	21.1	1218.9	201	1219.2	171
9	21.7	1218.1	213	1218.3	183
10	24.1	1216.1	216	1216.3	186
11	28.6	1213.2	252	1213.3	222
12	36.7	1210.6	288	1210.8	258
13	43.6	1207.3	321	1207.4	291

1/ Measured from time reservoir level exceeds the maximum operating limit.
2/ Measured from the beginning of failure.

TABLE 2C

COMPUTED ELEVATIONS AND TIMES OF ARRIVAL FOR FLOOD WAVE
SANDY LAKE DAM AND RESERVOIR

Section	Dist. Below Dam (mi.)	40% PMF Without Failure Max. Elev. (ft.)	40% PMF Without Failure Time of Max. Elev. (hr.)1/	40%PMF With Failure Max. Elev. (ft.)	40%PMF With Failure Time of Max. Elev. (hr.)2/
1	0.4	1222.6	129	1223.1	84
2	1.0	1221.1	129	1221.6	84
3	3.6	1220.4	156	1220.8	108
4	7.9	1219.0	192	1219.3	147
5	11.1	1216.2	201	1216.8	156
6	15.0	1216.0	222	1216.4	180
7	19.1	1214.4	225	1215.1	183
8	21.1	1214.0	225	1214.8	183
9	21.7	1213.4	234	1214.0	192
10	24.1	1211.5	240	1212.0	198
11	28.6	1209.5	273	1210.1	231
12	36.7	1206.3	306	1206.8	267
13	43.6	1204.8	339	1205.2	300

1/ Measured from time reservoir level exceeds the maximum operating limit.

2/ Measured from the beginning of failure.

TABLE 2D

COMPUTED ELEVATIONS AND TIMES OF ARRIVAL FOR FLOOD WAVE
SANDY LAKE DAM AND RESERVOIR

Section	Dist. Below Dam (mi.)	Threshold Flood Without Failure: Max. Elev. (ft.)	Threshold Flood Without Failure: Time of Max. Elev. (hr.)1/	Threshold Flood With Failure: Max. Elev. (ft.)	Threshold Flood With Failure: Time of Max. Elev. (hr.)2/
1	0.4	1218.8	90	1219.5	6
2	1.0	1218.5	90	1218.5	6
3	3.6	1217.1	123	1217.3	87
4	7.9	1215.7	168	1216.0	147
5	11.1	1213.5	174	1214.0	153
6	15.0	1212.1	186	1212.5	177
7	19.1	1209.7	189	1210.2	180
8	21.1	1208.4	189	1208.9	180
9	21.7	1207.3	192	1207.8	183
10	24.1	1207.0	198	1207.3	189
11	28.6	1204.9	231	1205.3	219
12	36.7	1202.2	252	1202.6	243
13	43.6	1199.8	264	1200.3	252

1/ Measured from time reservoir level exceeds the maximum operating limit.

2/ Measured from the beginning of failure.

TABLE 3

POTENTIAL SECONDARY PROBLEMS STEMMING FROM INUNDATION

SANDY LAKE DAM AND RESERVOIR

Plate	Area1/	Potential Secondary Problem Affecting Area
D-2	1	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-2	2	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-2	3	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-2,3	4	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-3	5	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-3	6	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-3	7	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-3,4	8	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-4	9	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.

1/ Key numbers are shown on Plates D-2 through D-5.

Note: Areas north of the Mississippi River upstream of Palisade may become isolated as portions of access roads become inundated.

TABLE 3 (CONT.)

Plate	Area1/	Potential Secondary Problem Affecting Area
D-4	10	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-4	11	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.
D-4	12	Inundated roads will affect these non-flooded areas by cutting off transportation into or out of the areas.

1/ Key numbers are shown on Plates D-2 through D-5.

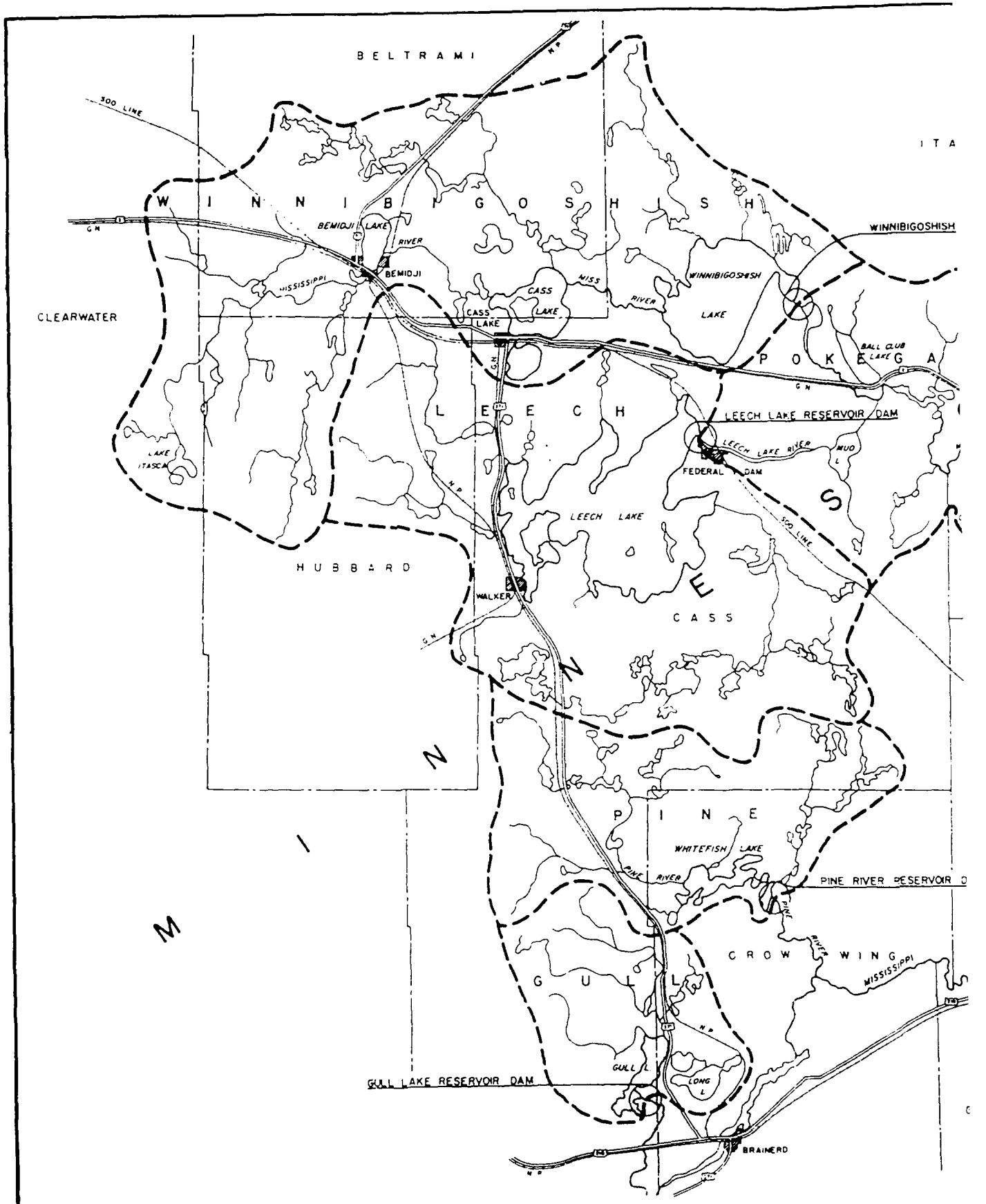
Note: Areas north of the Mississippi River upstream of Palisade may become isolated as portions of access roads become inundated.

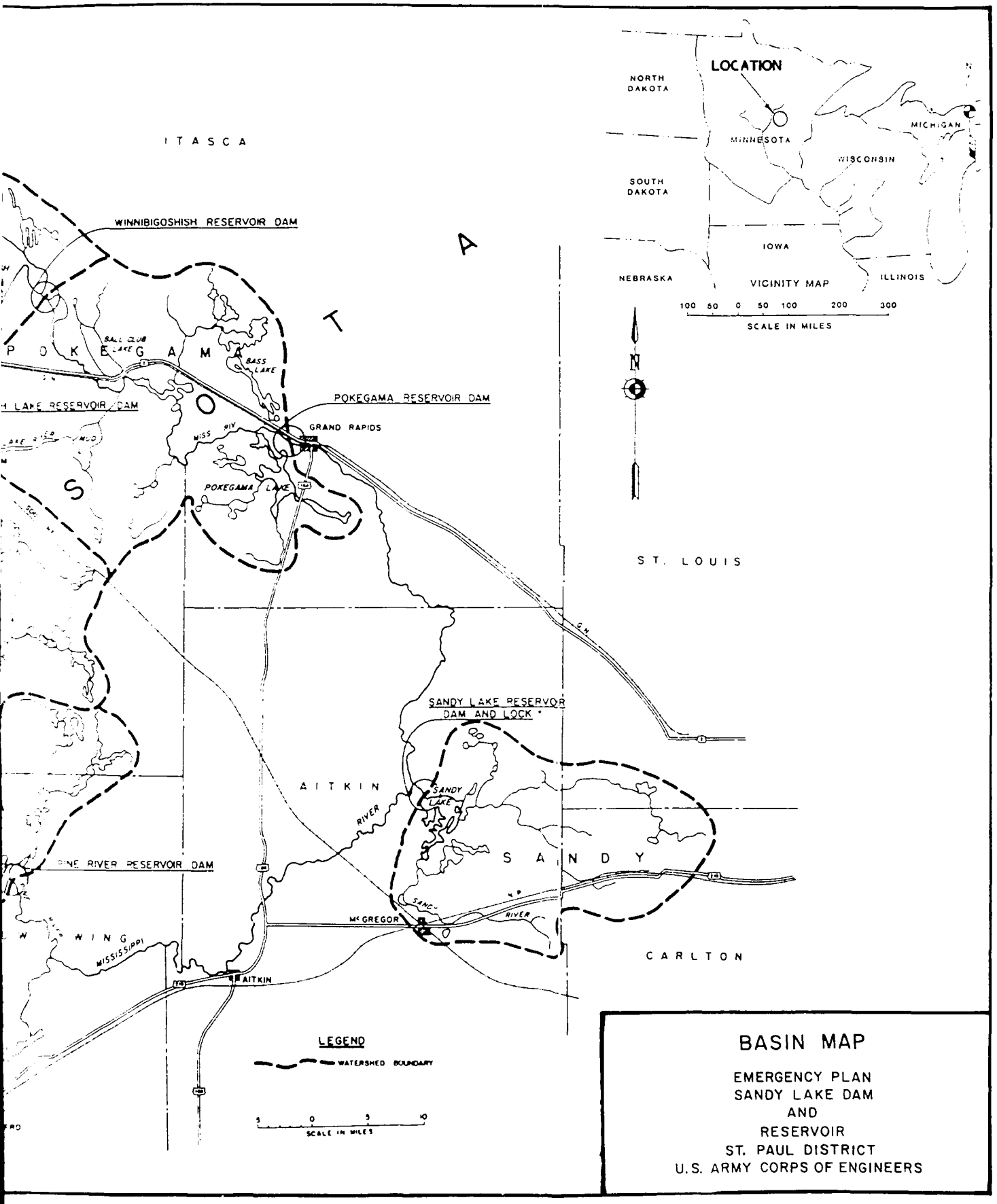
TABLE 4

CHARACTERISTICS OF EXISTING EVACUATION PLANS

SANDY LAKE DAM AND RESERVOIR

Plan Characteristic	Plan 1	Plan 2	Plan 3
Is plan written?	No	No	No
Is plan current?			
Does plan have legal status through appropriate adoption or recognition by non-federal authorities?			
Does plan specify actions to be taken in sufficient detail to avoid indecision on whether or not to execute the plan and how it should be executed?	* EVACUATION PLANS ARE A LOCAL RESPONSIBILITY *		
Does plan make specific assignments of responsibility for its initiation and execution?			
Does plan cover all parts of the jurisdiction requiring evacuation?			
Is successful execution of plan in potential emergency situations reasonable in view of the warning time likely to be available for an emergency?			
Is plan consistent with various causes of emergencies likely to exist at time evacuation is required?			
Does plan evidence realistic analysis of means of warning and transporting evacuees, lane capacities of escape routes and other pertinent matters?			
Are equipment, personnel and materials required for execution of the plan identified?			
Does plan contain adequate provisions for updating, testing, practice and other maintenance activities to assure its continued viability?			

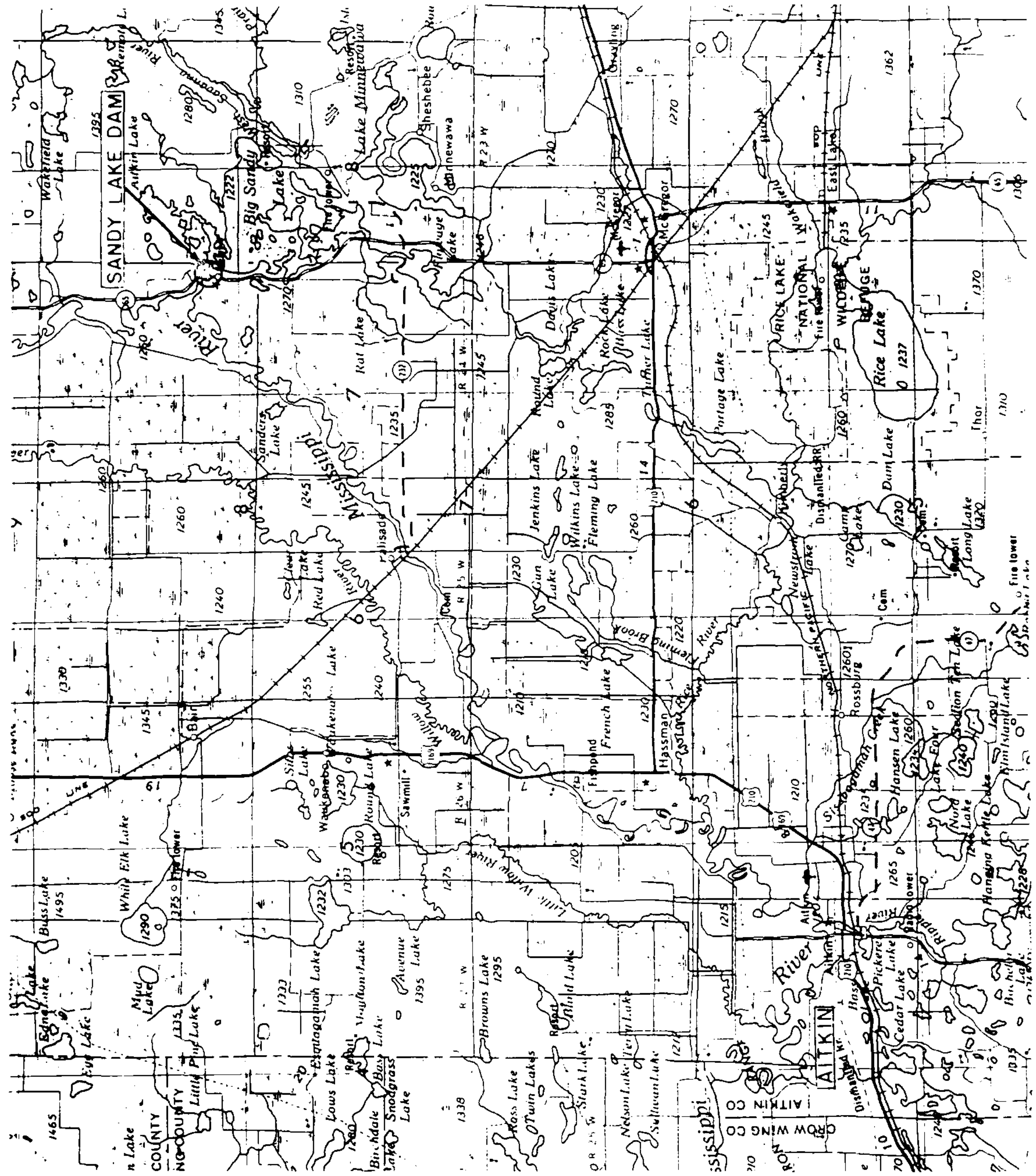

BELTRAMI
300 LINE
WINNIBIGOSHISH
CLEARWATER
BEMIDJI LAKE
RIVER
BEMIDJI
MISSISSIPPI
CASS LAKE
CASS LAKE
WINNIBIGOSHISH LAKE
WINNIBIGOSHISH
BALL CLUB LAKE
LEECH LAKE RESERVOIR DAM
LEECH LAKE RIVER
FEDERAL DAM
LAKE ITASCA
LEECH LAKE
HUBBARD
WALKER
CASS
PINE
WHITEFISH LAKE
PINE RIVER
PINE RIVER RESERVOIR
CROW WING
MISSISSIPPI
GULL
GULL LAKE RESERVOIR DAM
LONG L
BRAINERD

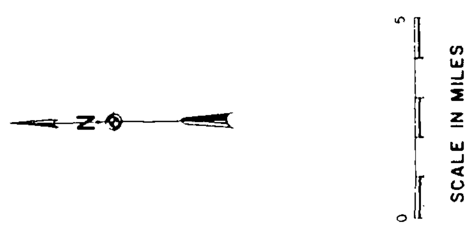


BASIN MAP

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE 1

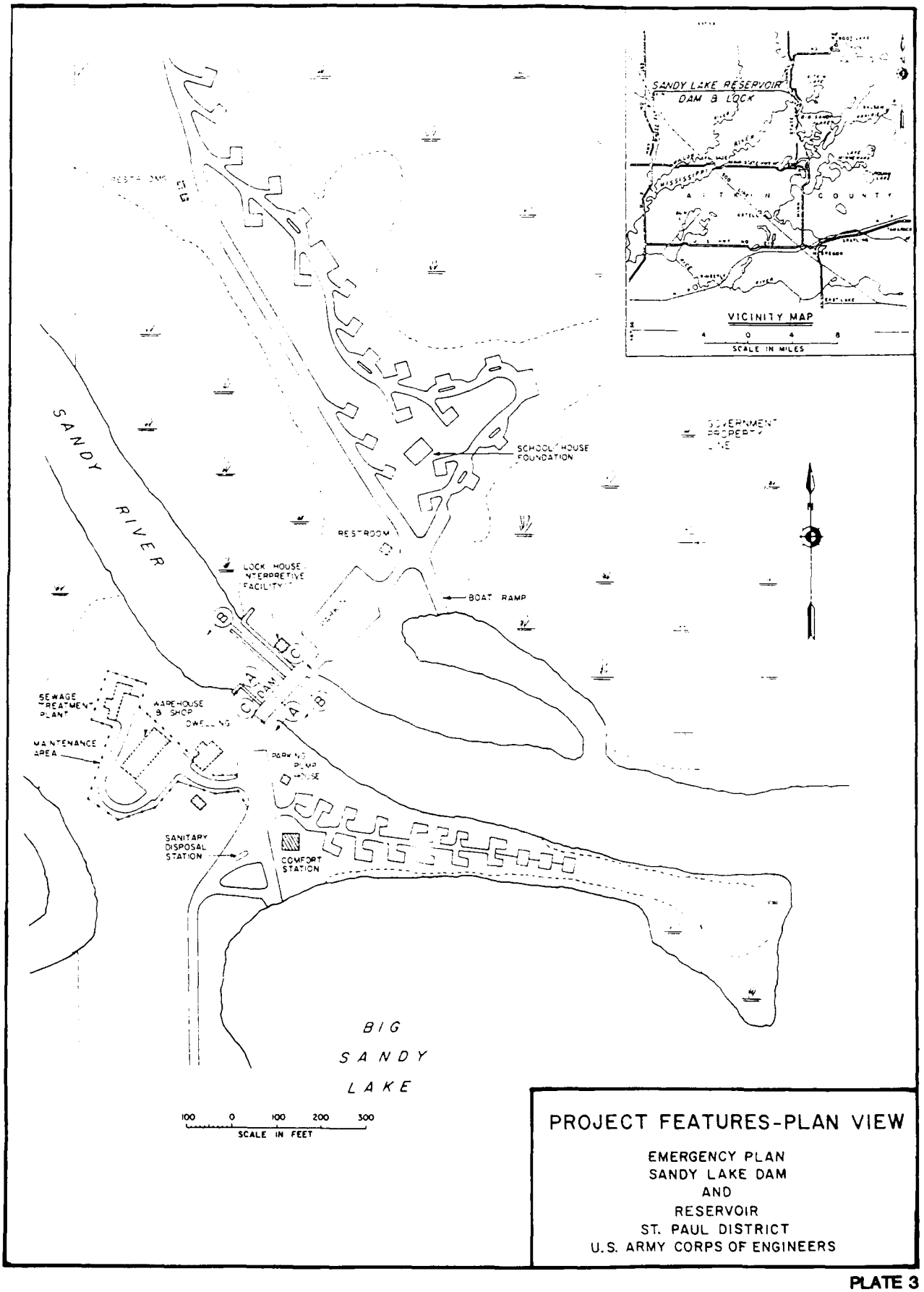




LOCATION MAP

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

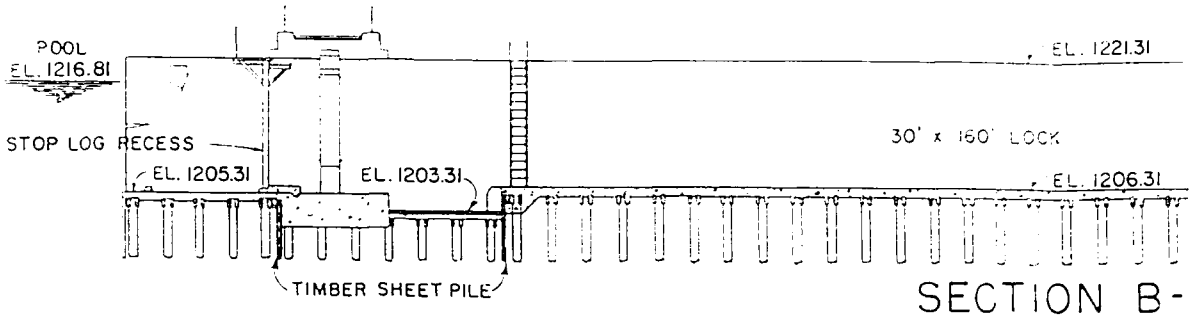
PLATE 2



PROJECT FEATURES-PLAN VIEW

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

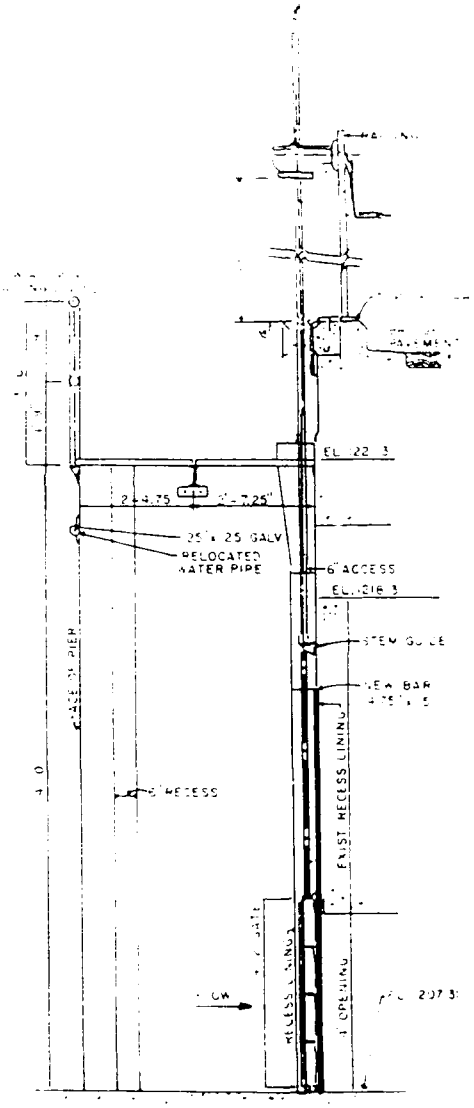
PLATE 3



SECTION B-

10' 0 10' 20'

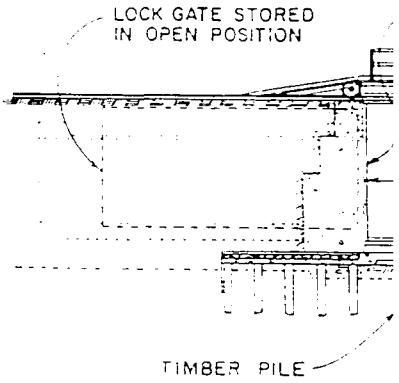
SCALE IN FEET

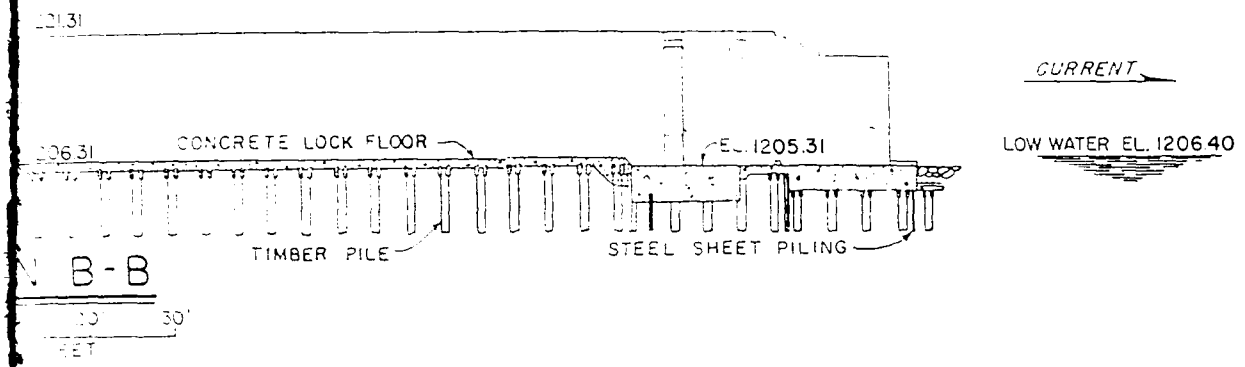


SECTION A-A

5 0 5

SCALE IN FEET

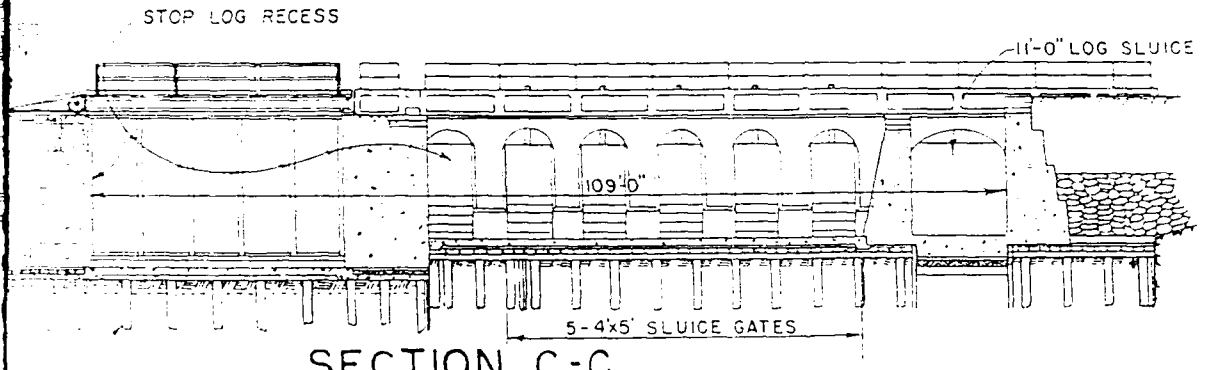




B-B

30'

FEET



SECTION C-C

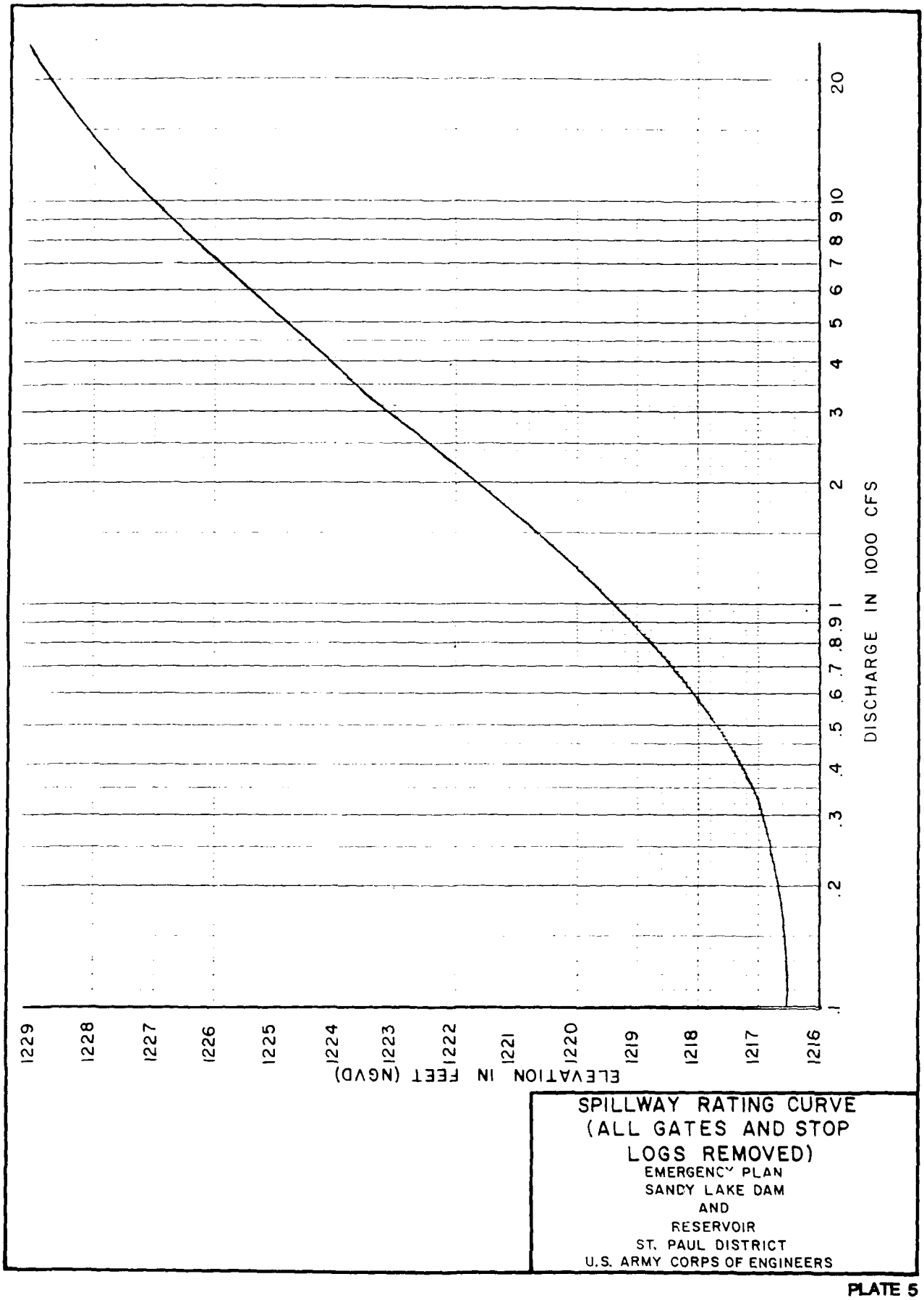
10 0 10 20 30

SCALE IN FEET

CROSS SECTIONS

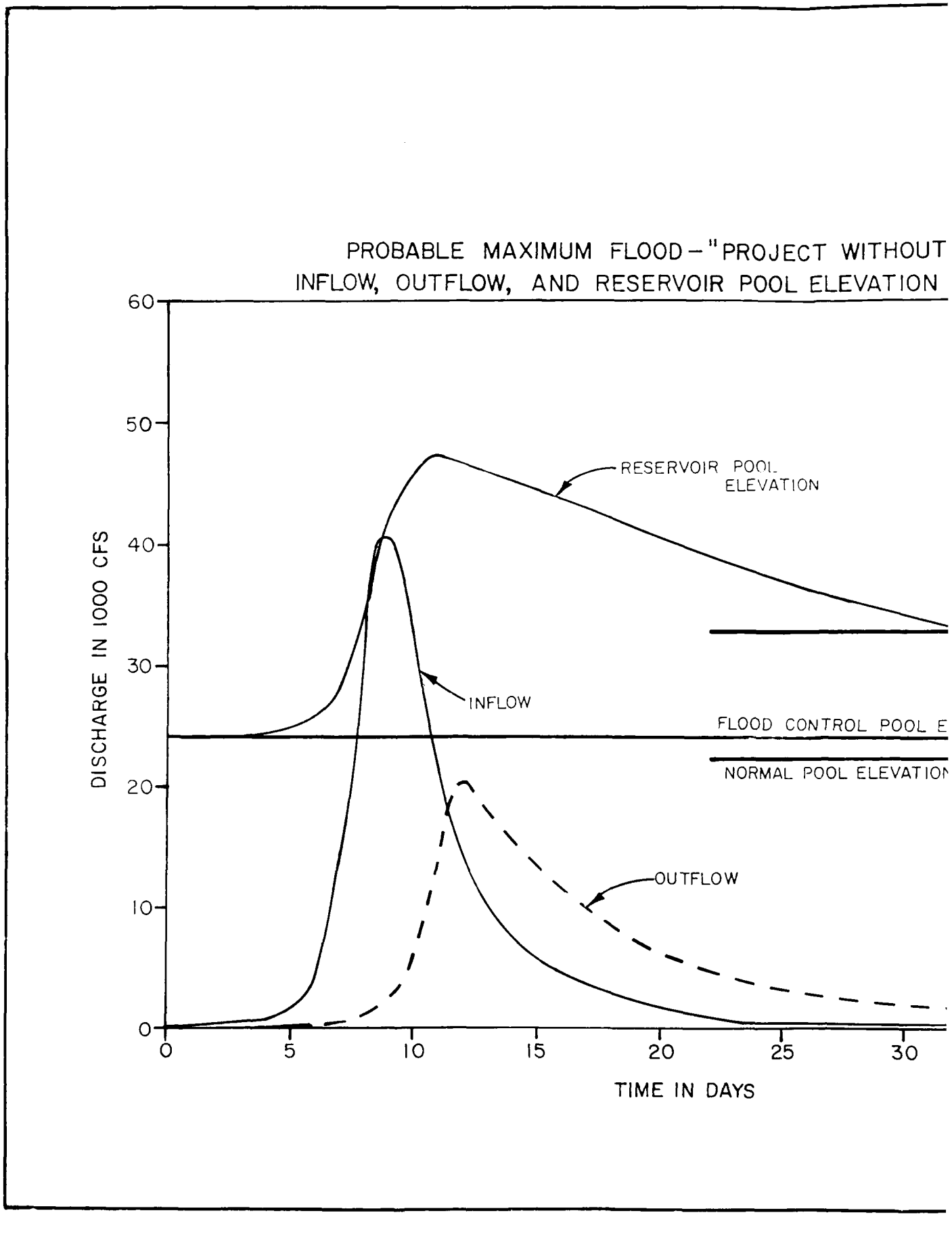
EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

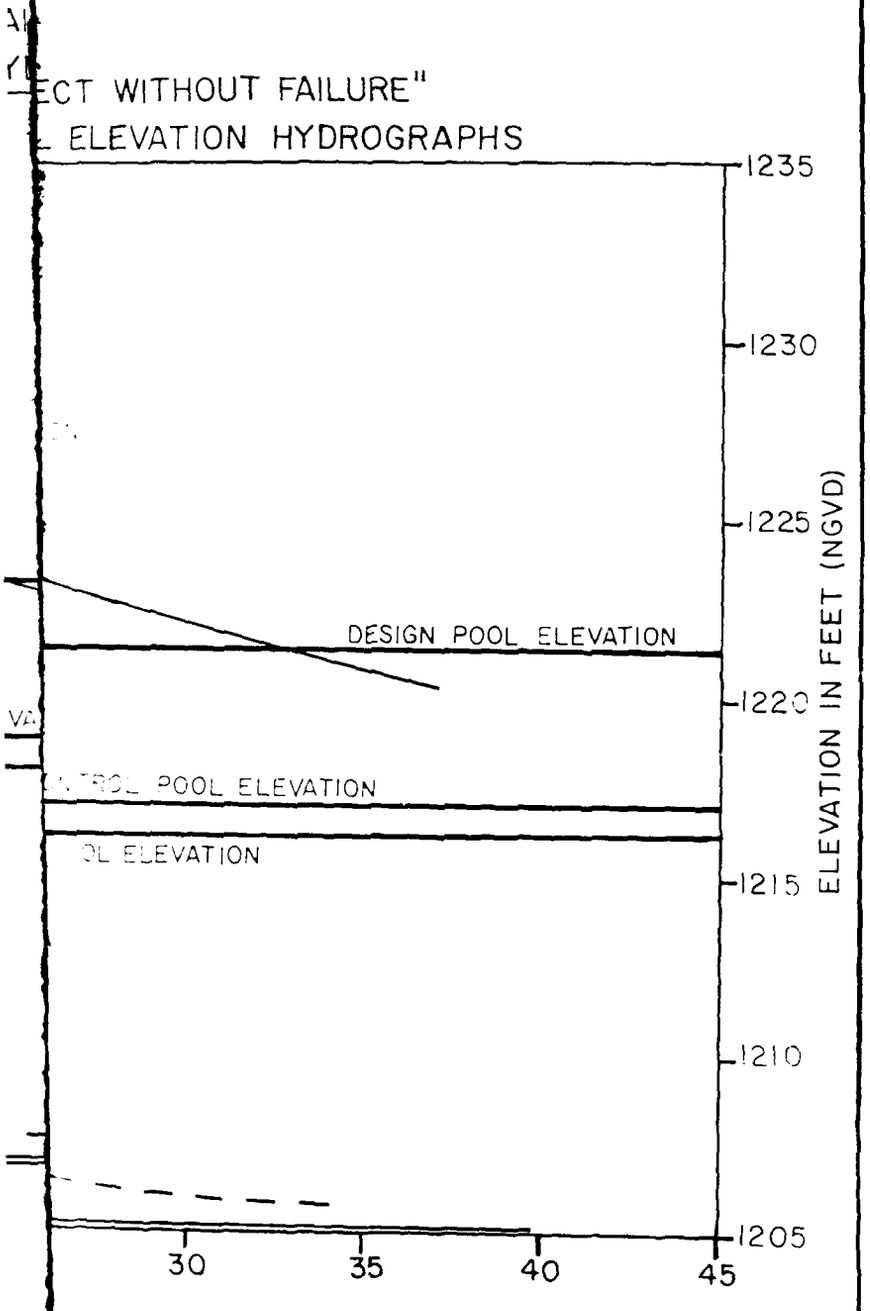
PLATE 4



SPILLWAY RATING CURVE
(ALL GATES AND STOP LOGS REMOVED)
EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE 5


PROBABLE MAXIMUM FLOOD – "PROJECT WITHOUT
INFLOW, OUTFLOW, AND RESERVOIR POOL ELEVATION
DISCHARGE IN 1000 CFS
60
50
40
30
20
10
0
RESERVOIR POOL ELEVATION
INFLOW
FLOOD CONTROL POOL E
NORMAL POOL ELEVATION
OUTFLOW
0
5
10
15
20
25
30
TIME IN DAYS

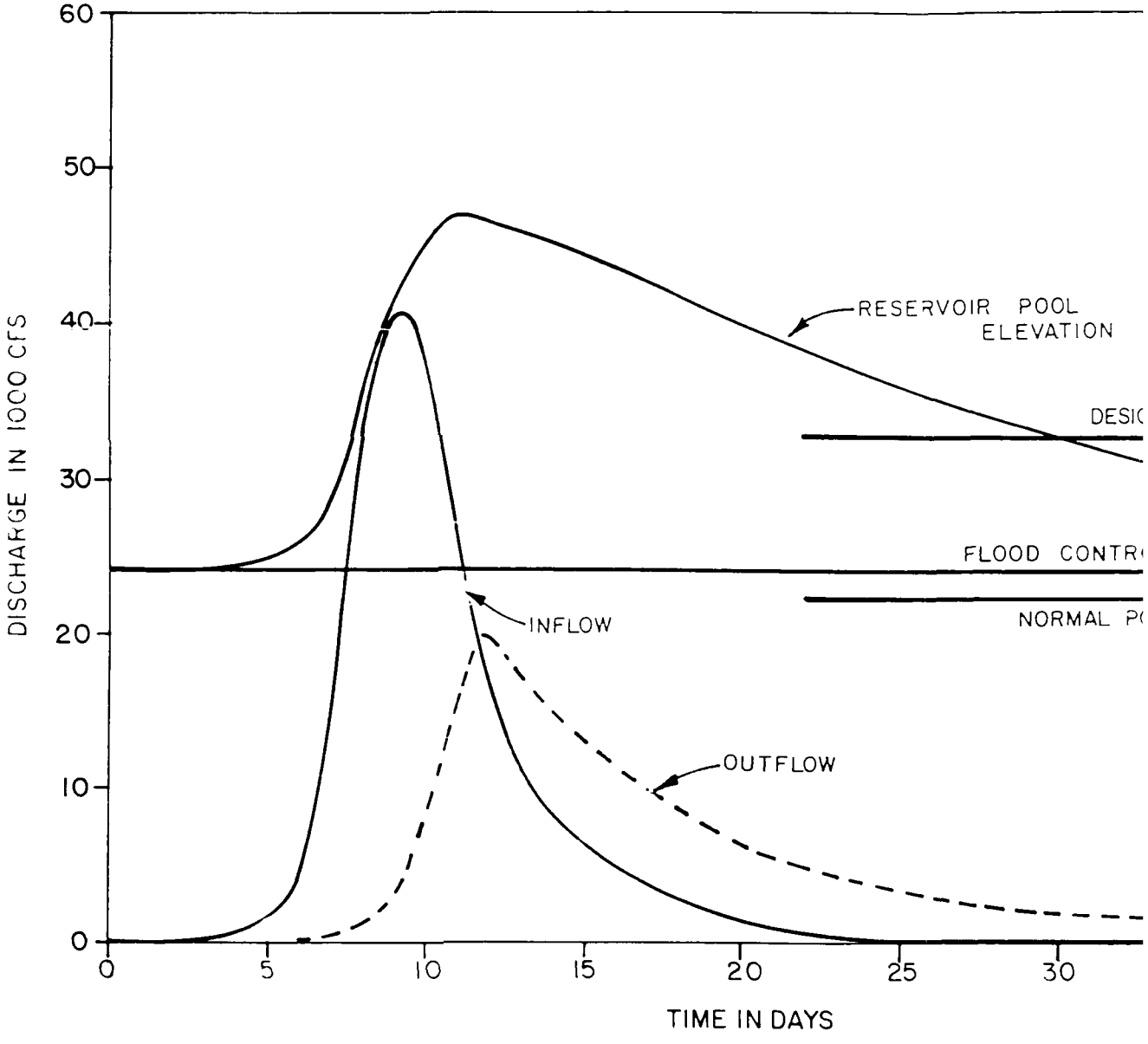


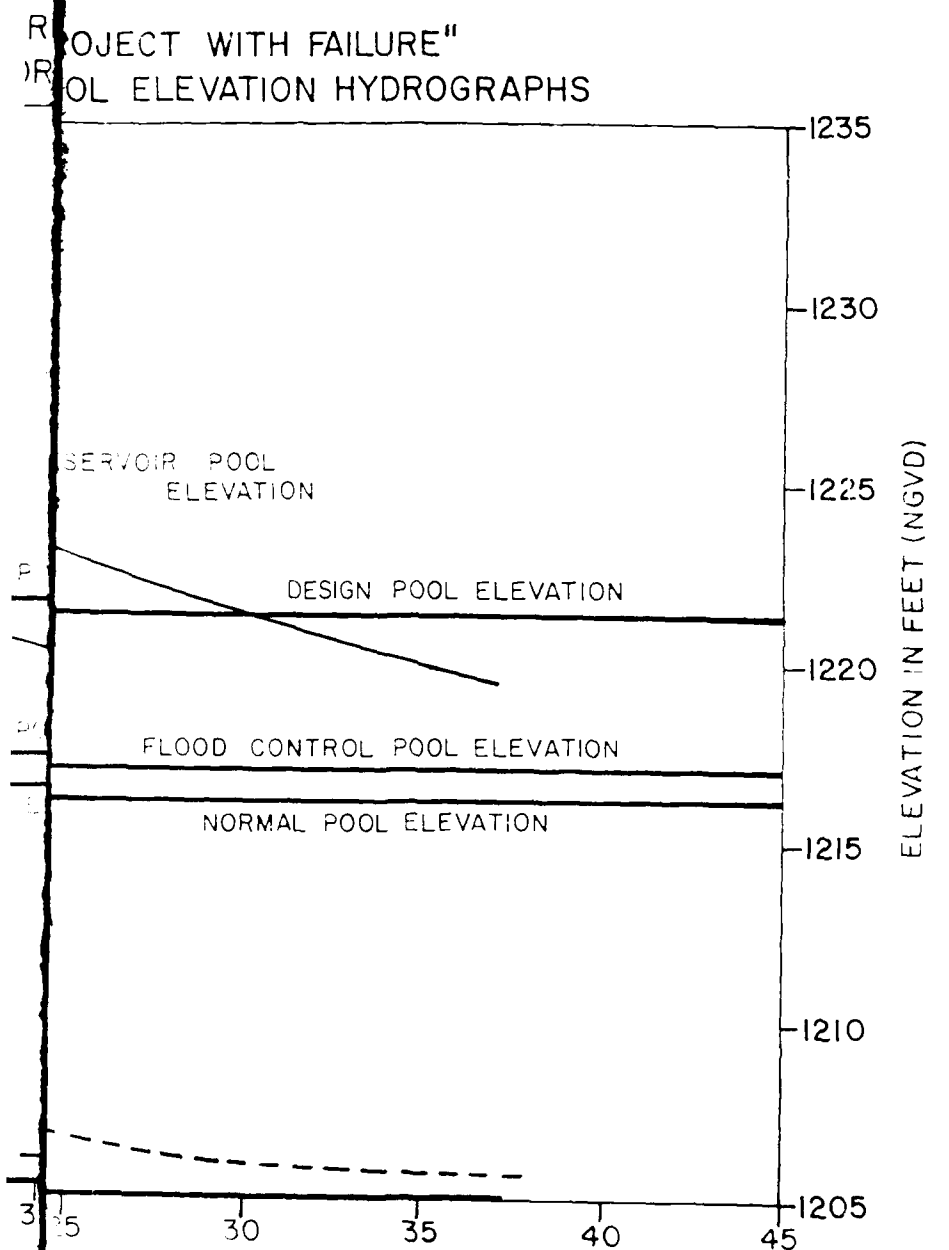
PROBABLE MAXIMUM FLOOD
"PROJECT WITHOUT FAILURE"
INFLOW, OUTFLOW, AND RESERVOIR
POOL ELEVATION HYDROGRAPHS

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE 6

PROBABLE MAXIMUM FLOOD – "PROJECT WITH FAI
INFLOW, OUTFLOW, AND RESERVOIR POOL ELEVATION H

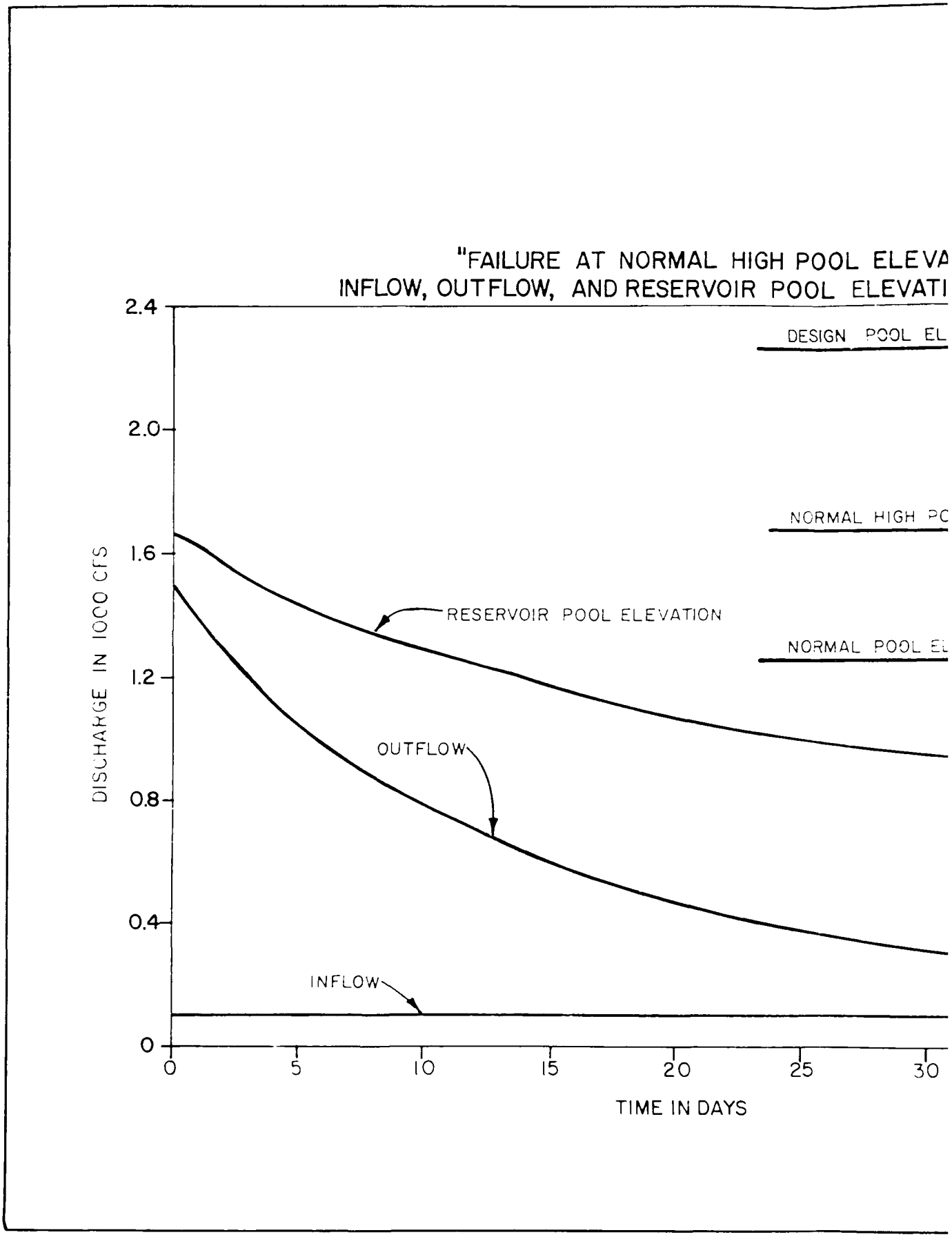


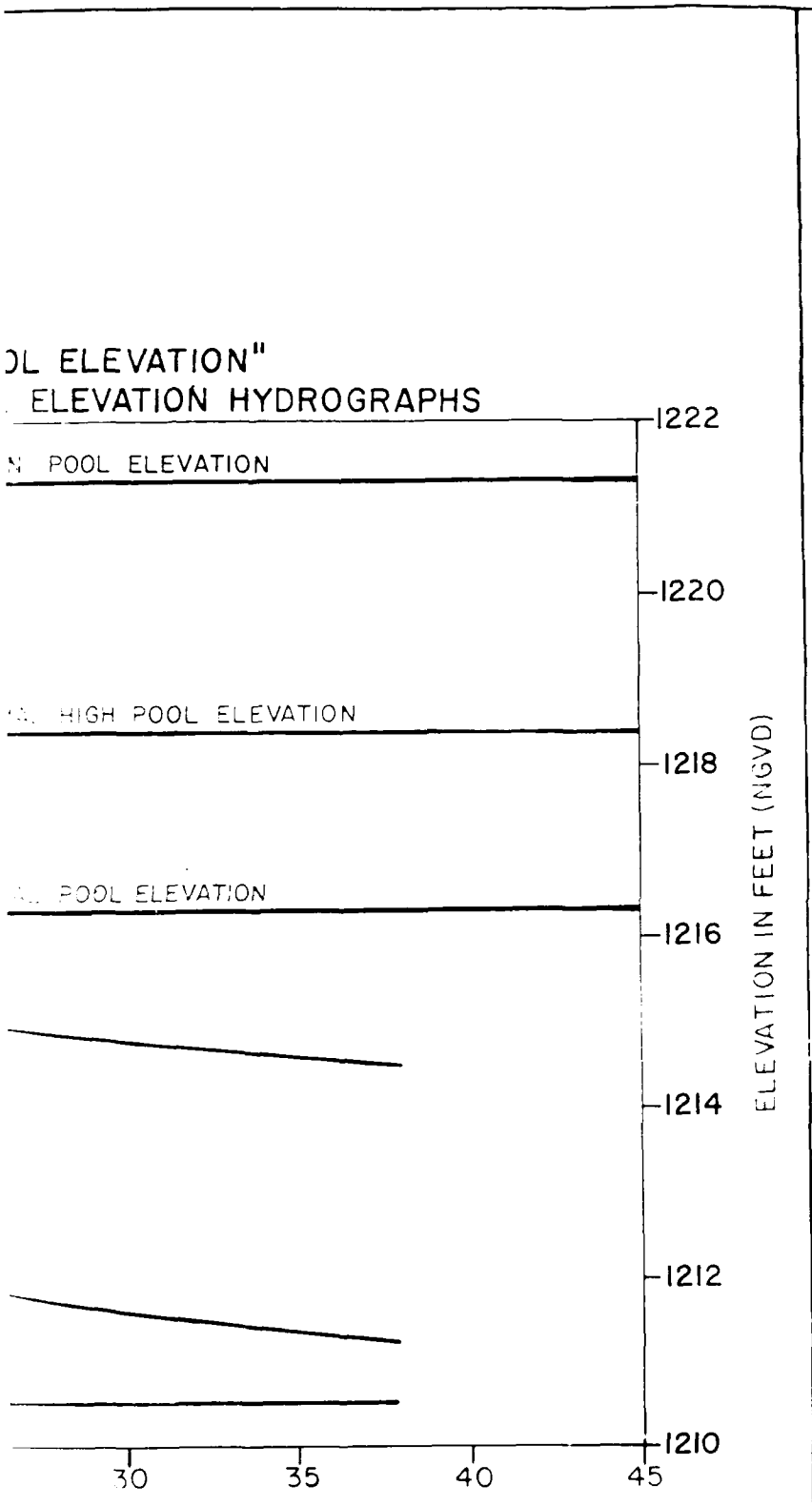


"PROJECT WITH FAILURE"
INFLOW, OUTFLOW, AND RESERVOIR
POOL ELEVATION HYDROGRAPHS

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE 7


"FAILURE AT NORMAL HIGH POOL ELEVA
INFLOW, OUTFLOW, AND RESERVOIR POOL ELEVATI
DESIGN POOL EL
NORMAL HIGH PO
NORMAL POOL EL
RESERVOIR POOL ELEVATION
OUTFLOW
INFLOW
DISCHARGE IN 1000 CFS
2.4
2.0
1.6
1.2
0.8
0.4
0
0
5
10
15
20
25
30
TIME IN DAYS

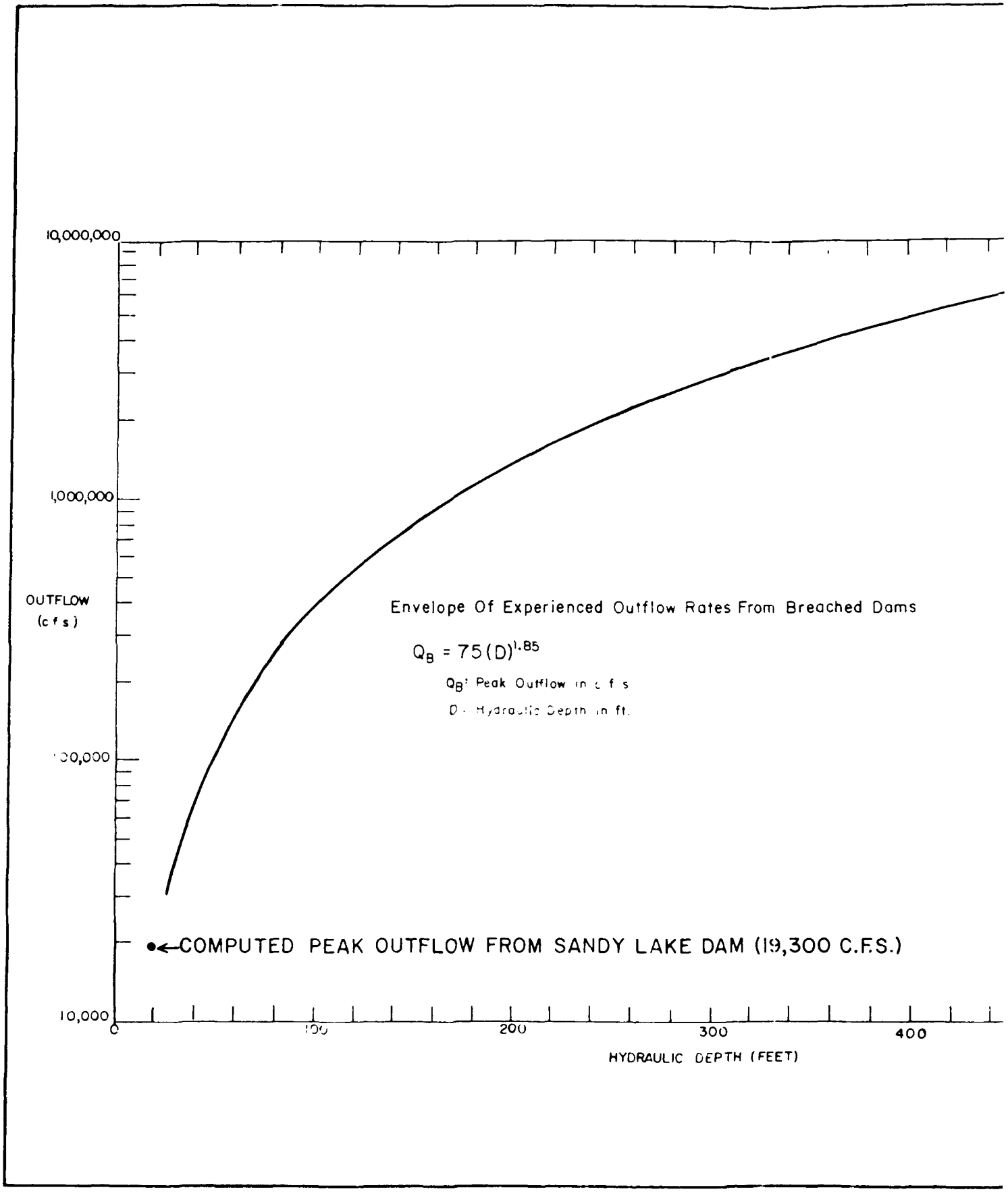


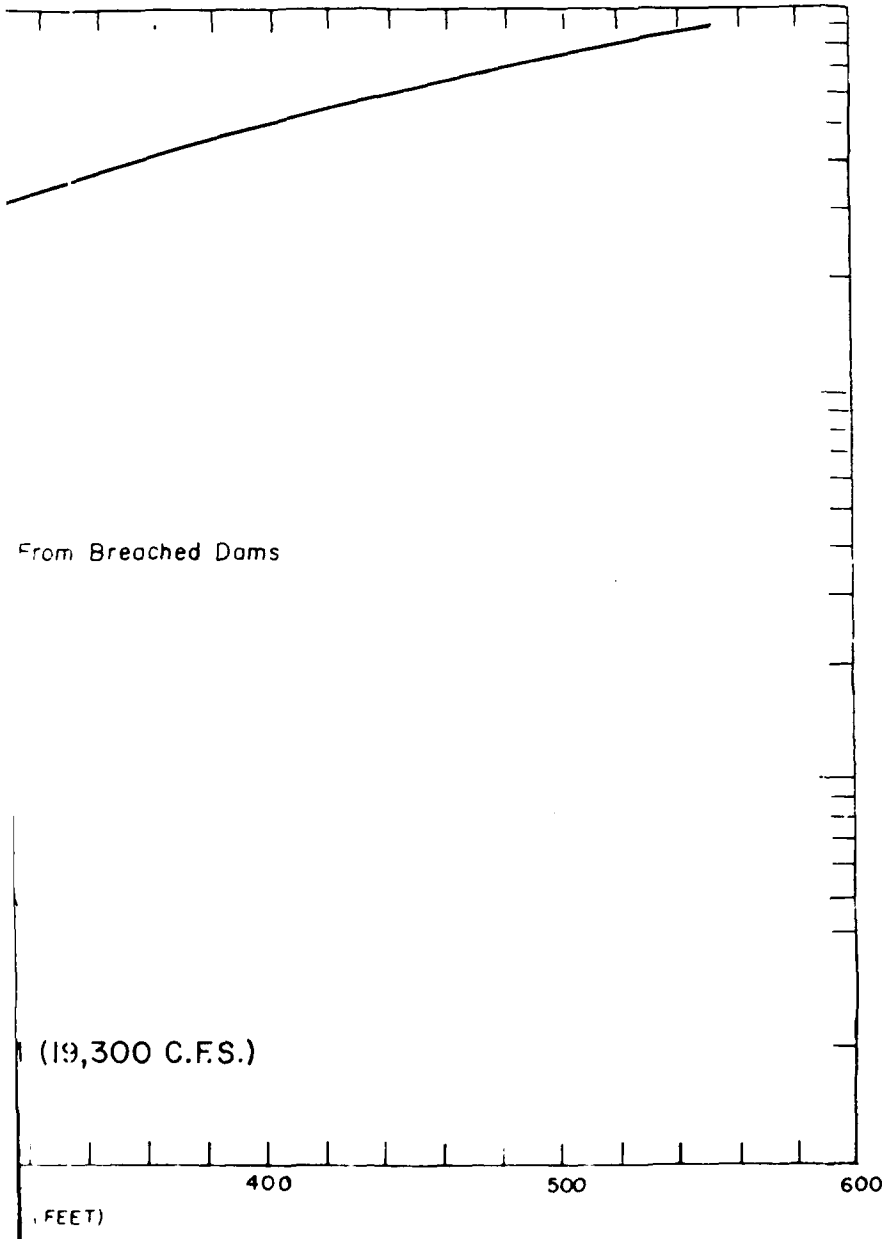
"FAILURE AT NORMAL HIGH POOL ELEVATION"

INFLOW, OUTFLOW, AND RESERVOIR POOL ELEVATION HYDROGRAPHS

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE 8

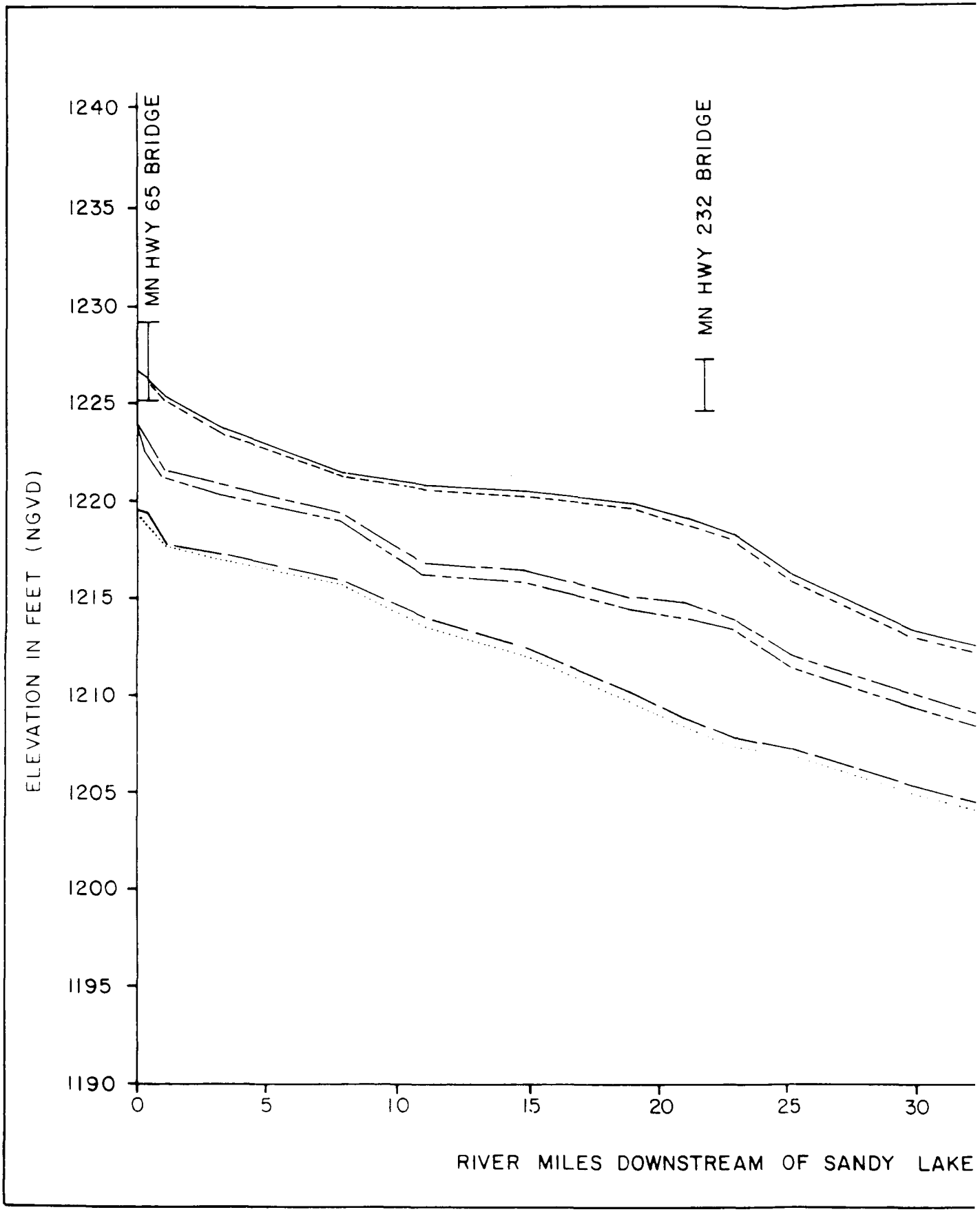

10,000,000
1,000,000
OUTFLOW
(c f s)
Envelope Of Experienced Outflow Rates From Breached Dams
$Q_B = 75(D)^{1.85}$
Q_B: Peak Outflow in c f s
D: Hydraulic Depth in ft.
COMPUTED PEAK OUTFLOW FROM SANDY LAKE DAM (19,300 C.F.S.)
10,000
0
100
200
300
400
HYDRAULIC DEPTH (FEET)

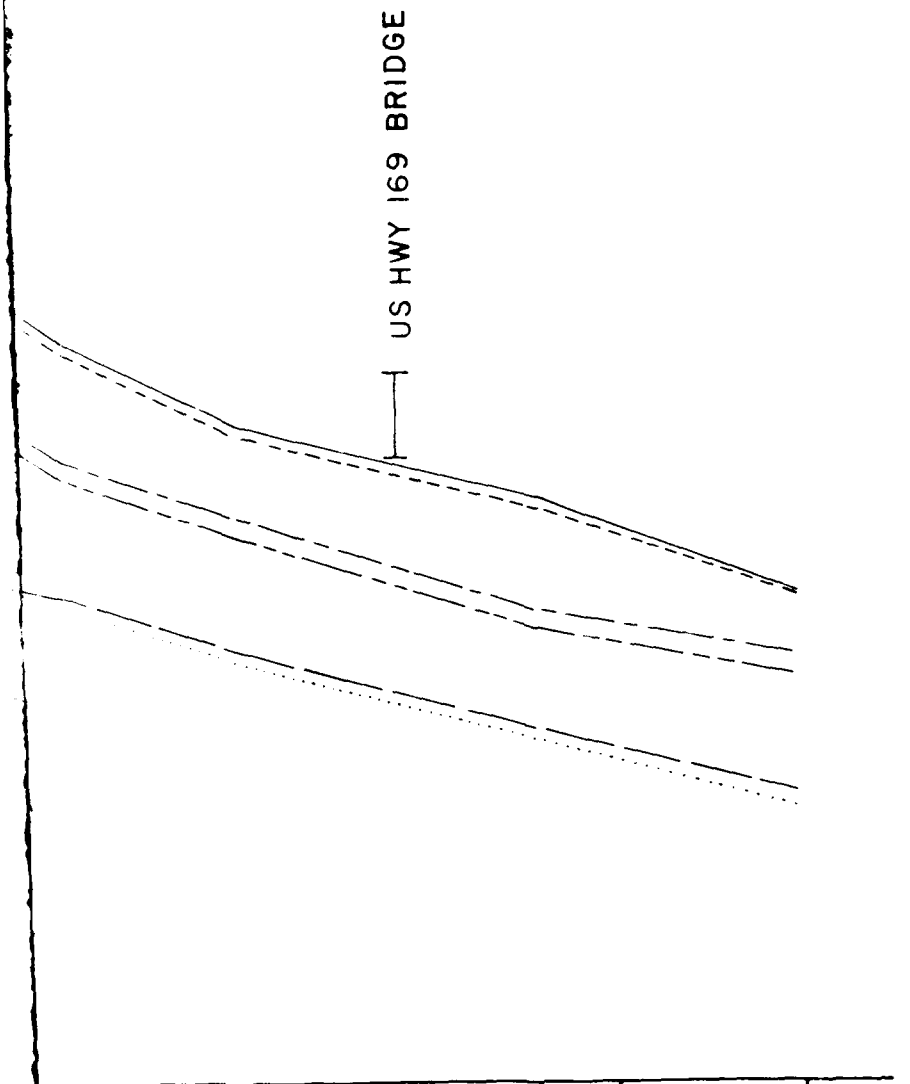


COMPARISON
OF
COMPUTED OUTFLOW RATES

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE 9


MN HWY 65 BRIDGE
MN HWY 232 BRIDGE
ELEVATION IN FEET (NGVD)
1240
1235
1230
1225
1220
1215
1210
1205
1200
1195
1190
0
5
10
15
20
25
30
RIVER MILES DOWNSTREAM OF SANDY LAKE



25 30 35 40 45

OF SANDY LAKE DAM

LEGEND

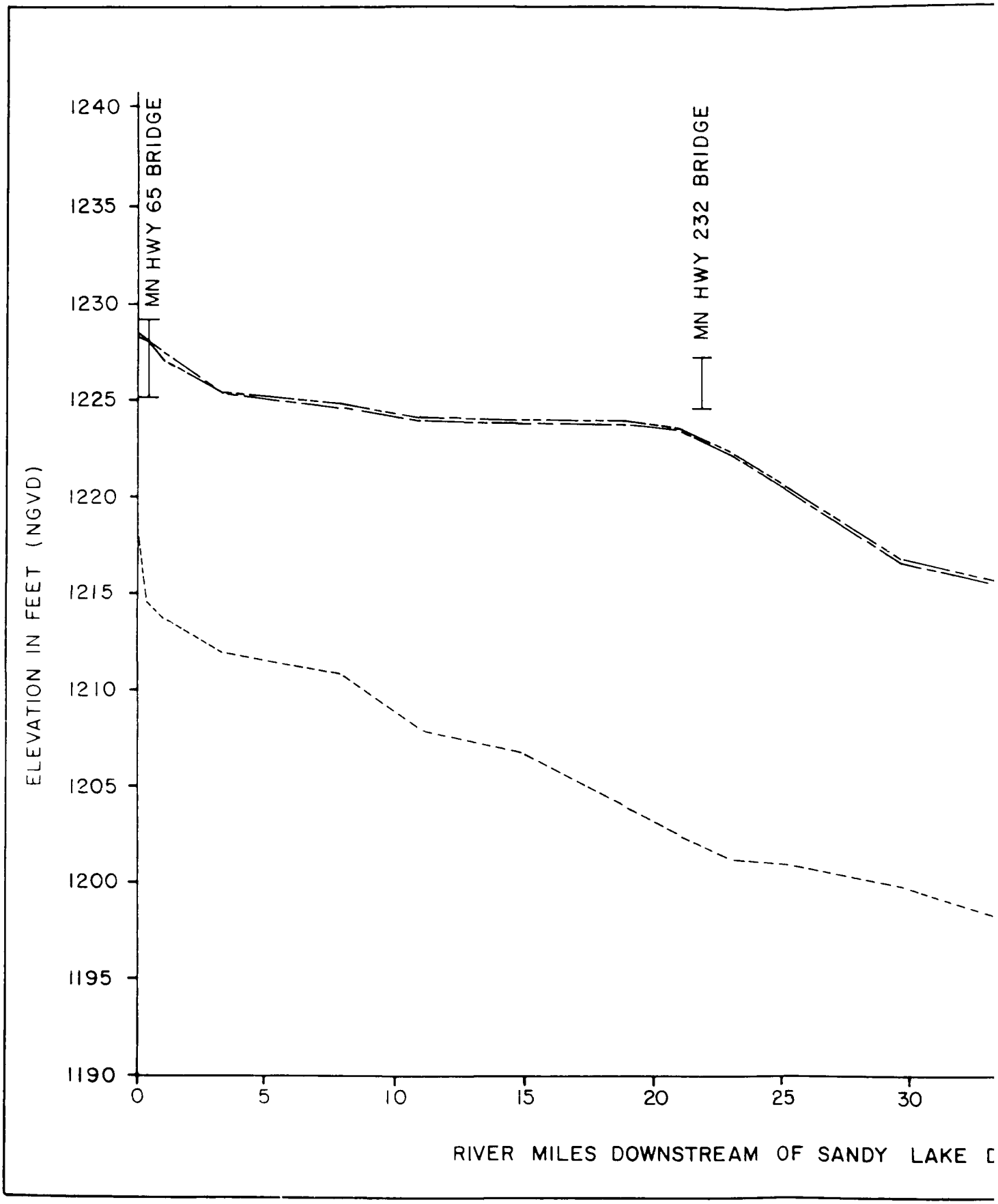
70 PERCENT PMF WITH FAILURE
70 PERCENT PMF WITHOUT FAILURE
40 PERCENT PMF WITH FAILURE
40 PERCENT PMF WITHOUT FAILURE
THRESHOLD FLOOD WITH FAILURE
THRESHOLD FLOOD WITHOUT FAILURE

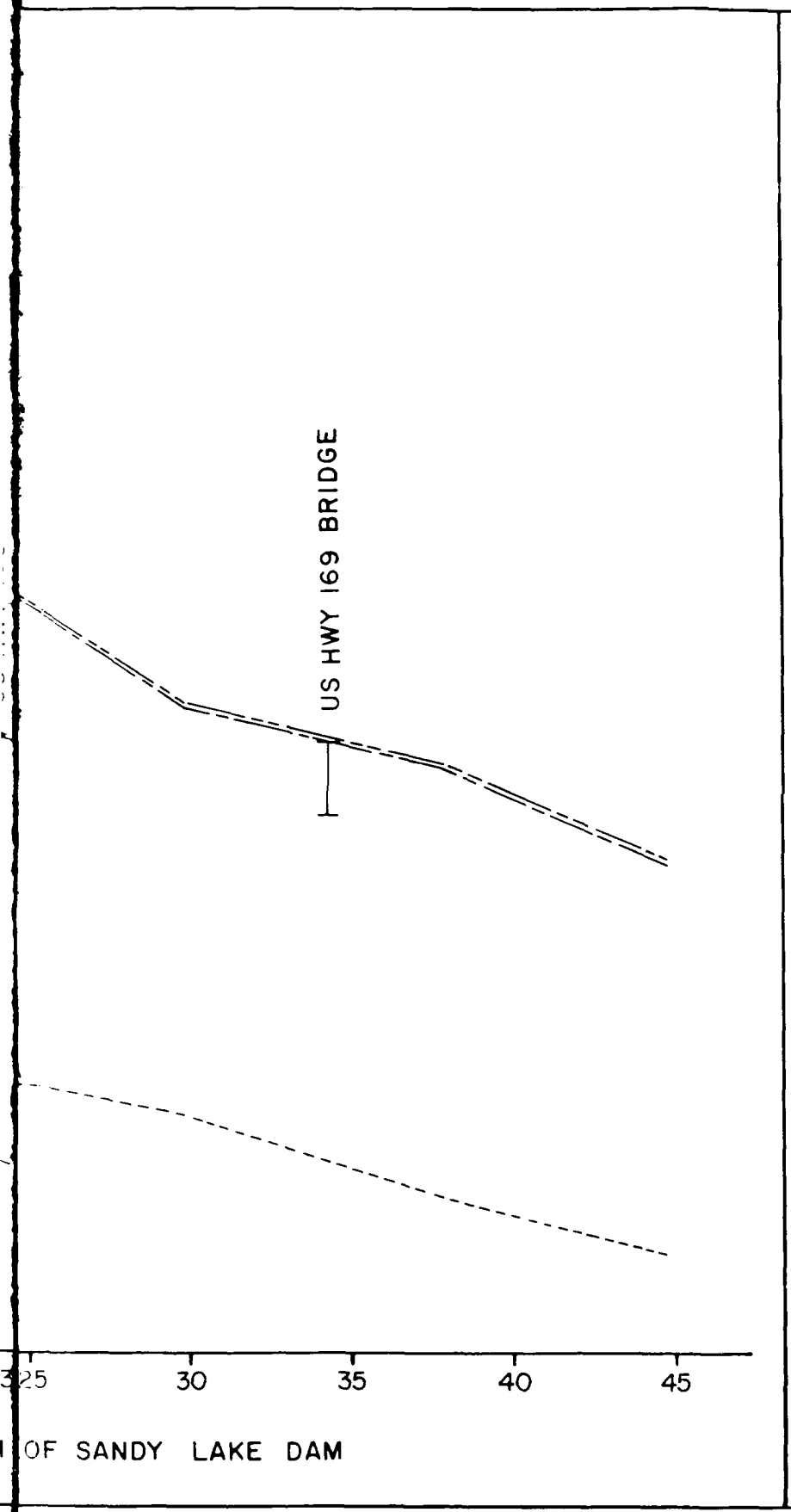
Top of Roadbed or Wall
Bridge Elevation
Low Chord or Top of Arch

CREST PROFILES

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE 10


MN HWY 65 BRIDGE
MN HWY 232 BRIDGE
1240
1235
1230
1225
1220
1215
1210
1205
1200
1195
1190
ELEVATION IN FEET (NGVD)
0
5
10
15
20
25
30
RIVER MILES DOWNSTREAM OF SANDY LAKE D



OF SANDY LAKE DAM

LEGEND

PROBABLE MAXIMUM FLOOD WITH FAILURE

PROBABLE MAXIMUM FLOOD WITHOUT FAILURE

FAILURE AT NORMAL HIGH POOL ELEVATION

Top of Roadbed or Wall
Bridge Elevation
Low Chord or Top of Arch

CREST PROFILES

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE 11

EMERGENCY IDENTIFICATION SUBPLAN

APPENDIX A

TO

EMERGENCY PLAN

FOR

SANDY LAKE DAM AND RESERVOIR

JUNE 1987

TABLE OF CONTENTS

Table

EMERGENCY IDENTIFICATION SUBPLAN

SANDY LAKE DAM AND RESERVOIR

A-1. Introduction

Conditions affecting operation of Sandy Lake Dam and Reservoir could result in a hazard to life and/or property due to high reservoir levels and/or sudden release of large volumes of water. Early identification of the existence or potential for occurrence of such conditions is essential as a basis for initiating emergency operations and/or repairs and for issuing appropriate notifications to higher authority and potentially affected parties.

a. Purpose

This subplan implements a portion of the Corps program to prepare emergency plans for all Corps dams. It establishes procedures for identifying impending and existing emergencies affecting the operation and safety of Sandy Lake Dam.

b. Scope

This subplan deals with identification of impending and existing emergencies related to operation error, excess seepage, foundation failure, abutment failure, extreme storm, equipment failure and upstream dam failure. Instructions are included concerning:

(1) Monitoring and reporting conditions.

(a) Routine - during duty hours. Monday through Friday (0800 - 1630).

(b) Non-routine - on a 24-hour basis or as directed by District Office. Additional personnel may be required at discretion of Mississippi Headwaters Project Office.

(2) Communications between the project office, St. Paul District Office, and Mississippi Headwaters Project Office.

(3) Criteria for action including declaration of a pre-emergency or emergency condition and activation of the Notification Subplan and/or Emergency Operations and Repair Subplan.

c. Applicability

This subplan is applicable to all Corps elements and field offices concerned with operation of Sandy Lake Dam and Reservoir.

A-2. Definitions

a. Pre-emergency

A "pre-emergency" condition is one in which some impending or existing threat to the safe operation of the dam or reservoir is identified but no significant hazard to life or property is expected to occur. Declaration of a pre-emergency condition is internal to the Corps of Engineers and does not require notification of other parties or warnings to evacuate.

b. Emergency

An "emergency" condition is one in which the occurrence of a significant hazard to life and/or property is possible or certain to occur. Conditions justifying declaration of an emergency condition may be imminent or longer term. Declaration of an emergency condition requires notification of key personnel and issuance of warnings to evacuate potentially hazardous areas.

c. Park Manager

The term "Park Manager" means the dam tender or the individual in charge at the Sandy Lake Dam and Reservoir project site.

d. Mississippi Headwaters Project Office

The term "Mississippi Headwaters Project Office" means the person in charge of the Mississippi Headwaters Project Office.

e. District

The term "District" means one of the following elements depending upon which is appropriate for the situation at hand.

(1) Dam Safety Officer. The Dam Safety Officer must be kept informed of all pre-emergency or emergency situations. Responsible for identifying and/or providing the necessary engineering or technical support for keeping the Dam Safety Committee and the NCD Dam Safety Officer informed of the pre-emergency or emergency situation.

(2) Project Operations Branch. Responsible for identifying a person-in-charge of the pre-emergency or emergency

situation. Responsible for keeping the Dam Safety Officer informed of the pre-emergency or emergency situation. Also, responsible for matters involving normal dam operations, and/or other matters not covered by the other District elements.

(3) Emergency Operations Center. Provides a 24-hour telephone contact with the District Office. Responsible for keeping the Dam Safety Officer, the Commander/District Engineer, and NCD in contact with the operations and personnel. Also, responsible for matters involving national security, disasters, and mobilization.

(4) Water Control Center. Part of Hydrology Section in Geotechnical, Hydraulics and Hydrologic Engineering.

(5) Geotechnical Design Section. A section in the Geotechnical, Hydraulics and Hydrologic Engineering Branch. Responsible for matters involving the structural integrity of the dam.

(6) Design Branch. Responsible for matters involving the structural integrity of the outlet structures.

(7) Project Management Branch. Responsible for management support.

(8) Planning Division. Responsible for management support and matters involving environmental analysis and cultural resources.

A-3. Responsibility For Conduct

a. Park Manager

(1) Carrying out routine surveillance (paragraph A-4a).

(2) Carrying out non-routine observations and measurements as directed by the District (paragraph A-4b).

(3) Advising District of potentially hazardous situations (paragraph A-4c, Table A-1).

(4) Maintaining proper records of communications (paragraph A-5).

(5) Acting independently, when required by disruption of communications or the urgency of the circumstances, to declare a pre-emergency or emergency condition (paragraph A-8) and to activate the Notification Subplan and/or Emergency Operations and Repair Subplan as appropriate.

b. **Mississippi Headwaters Project Office**

(1) Providing direction and supervision to the Park Manager in coordination with the District Office.

(2) Providing assistance to District as requested.

(3) Assuming responsibilities of District in event of disruption of communications between the project area and District Office.

c. **District**

(1) Carrying out routine monitoring of conditions potentially affecting regulation of Sandy Lake Dam (paragraph A-6a) and alerting the Park Manager of situations requiring increased readiness and/or 24-hour supervision.

(2) Providing guidance to the Park Manager on all potentially hazardous situations which arise and directing any non-routine observations and measurements needed to assist in identification, confirmation or analysis of existing or impending threats to safe operation of the dam (paragraph A-6b).

(3) Providing personnel for on-site evaluation of potentially hazardous conditions related to geology, soils and other aspects requiring expert analysis.

(4) Declaring the existence of pre-emergency and emergency conditions and directing activation of the Emergency Operations and Repair Subplan and/or Notification Subplan (Appendices B & C).

(5) Maintenance of the Subplan (paragraph A-9).

A-4. Observations, Tests and Reports by Park Manager

a. **Routine Observations and Tests**

(1) Monday through Friday (0800-1630).

(a) Maximum, minimum and observed temperature.

(b) Local precipitation at Maintenance Building.

(c) Wind speed.

(d) Pool and tailwater elevations.

(e) Gate setting.

(2) Weekly.

(a) Snow cover, water content (seasonal) at Maintenance Building.

(b) Test radio and other communications equipment.

(c) Read lake gages throughout the region.

(3) Monthly.

(a) Visual inspection for excess seepage of downstream face of embankment, weir, discharge pipes into outlet works, abutment areas, and valley floor immediately downstream of dam.

(b) Visual inspection for slope failure of both faces of all embankments which are in contact with standing water.

b. Non-routine Observations and Tests

(1) Perform snow surveys as requested (seasonal).

(2) Perform comprehensive examination of seepage (amount, rate of change of flow, and presence of fines) whenever potential problems are observed.

(3) Monitor precipitation gages as directed by the District Office when significant rain is occurring.

(4) Examine all areas of embankment hourly if evidence of significant slope failure is found (to be continued until directed by District to cease).

(5) Perform other observations and tests as directed by the District Office.

c. Reports

(1) To the Chief, Water Control Center (Table A-1).

(a) Reports precipitation of 1.5 inches or more in 24 hours or less in the vicinity of the dam.

(b) Pool elevation above seasonal normal.

(c) Reported severe ice conditions or temporary constrictions downstream of dam.

(d) Any conditions likely to require a change in gate operations or mode of regulation.

(2) To the Chief, Geotechnical Design Section (Table A-1).

(a) Any conditions indicating distress of an embankment.

(b) Indications of unusual seepage.

A-5. Records

The Park Manager will keep a log of all telephone, radio or other communications received from or sent to the District Office. This log should be a bound ledger or notebook used only as an official diary. Each communication will be described including:

a. Date

b. Time

c. Person calling or called

d. Information transmitted/instructions received

e. Action requested by the District

f. Action taken in response to request

g. Result of action

h. Remarks

i. Name of the operator issuing information/orders

j. Initials of person receiving communications

A-6. Observations, Tests and Alerts by the District Office

a. Daily Routine Observations and Tests

(1) Check weather forecasts for areas affecting runoff.

(2) Check concurrence of pool level readings from staff gage and recording gage.

(3) Record, review and analyze piezometer and weir reading data and check with Geotechnical Design Section.

b. Non-routine Observations and Tests

Specify additional observations and tests by the Park Manager and make additional observations and tests as necessary to:

(1) Assure proper functioning of all instrumentation.

(2) Assist in identification, confirmation or analysis of existing or impending threats to safe operation of the dam.

c. Alerts

Provide alerts to Park Manager and appropriate District Office personnel when:

(1) Weather, ice or other conditions require heightened readiness, increased surveillance or the possible need for activation of the Emergency Operations Center (Appendix C).

(2) Consideration is being given to declaration of a pre-emergency or emergency condition.

A-7. Communications

a. Normal

Communications between the District and Park Manager will normally be by radio. Radios at the Hastings Electronic Service Center and the District Emergency Operations Center will be manned on a 24-hour basis during all flood emergencies and whenever a pre-emergency or emergency condition is in effect. VHF-FM radio is used for communication between Headwaters sites. Radio frequencies and call letters for pertinent parties are listed in Table A-1.

b. Back-up

The telephone communications network between the District Office and Mississippi Headwaters Project Office will be used to back-up radio communications. Office and home phone numbers of key District Office and Mississippi Headwaters Project Office personnel are listed in Table A-1.

c. Emergency

During a situation when both radio and telephone communications between the District Office and the Sandy Lake Project Office are lost, others equipped with radio or telephone facilities will be called on for assistance. Those to whom application for assistance may be made are listed in Table A-1 along with the information for telephone and radio contacts.

A-8. Declaration of Pre-emergency and Emergency Conditions

a. Responsibility

The District Office is responsible for the declaration of "pre-emergency" or "emergency" conditions in all but extreme cases where the loss of communications or the speed of onset of a situation prevents the Park Manager from conferring with the District Office.

Pre-emergency and emergency declarations will be made by the Commander/District Engineer. The Chief of Engineering Division, members of Geotechnical, Hydraulics and Hydrology Branch, Design Branch, Project Operations Branch and the Emergency Operations Center will provide recommendations for the decision making process.

b. Conditions Warranting Declaration

Not every situation requiring declaration of a pre-emergency or an emergency condition can be specified. Initiative must be exercised by all involved personnel and each situation judged individually on the basis of all relevant factors.

(1) Pre-emergency

Examples of circumstances warranting declaration of a pre-emergency condition include:

(a) Malfunction of the flood control gate system during flood operations which impedes release of water and creates potential for overtopping.

(b) Minor seepage problems including: unexplained increases or decreases in amount, cloudy appearance of seepage or presence of fines, developing of new seepage areas as indicated by soft boggy areas or new or lush vegetation, and substantial unexplained fluctuation in piezometer readings.

(c) Minor slope failures including: tension cracks in the crest or slopes of embankment, small bulges in slopes or in foundation near toe of slope, small depressions or sags in crest or slopes, changes in horizontal crest alignment, and gullies forming in or near embankment or junction of the embankment abutments.

(d) Threats of sabotage or occurrence of sabotage of non-critical project features.

(2) Emergency

Examples of conditions warranting declaration of an emergency condition include:

(a) Pools are over summer band, and inflows are increasing.

(b) Major seepage problems including: large increases in piezometer readings, movement of large amounts of material in existing or new seeps, pipes in embankment or foundation materials, seepage at higher elevations on downstream face of dam or in abutment areas, and substantial increases in normal seepage amounts (especially when associated with movement of material from embankment of foundation.)

(c) Major slope failures including: appreciable depressions or sloughs in the crest or slopes of the dam or bulges in the slopes or foundation, large gullies developing and continuing to erode in the embankment or at the junction of the embankment and abutments, displacement of structures or instrumentation on the dam and continuing expansion of tension cracks after their appearance on the dam crest or slopes.

(d) Threats of sabotage or occurrence of sabotage to critical project features.

c. Action Upon Declaration

(1) Park Manager

(a) Attend telephones as directed by the District Office. Cancel normal schedules and provide for 24-hour duty as needed.

(b) Activate appropriate portions of Emergency Operations and Repair Subplan and/or Notification Subplan (Appendices B & C).

(c) Maintain 24-hour monitoring/surveillance of situation responsible for declaration.

(d) Perform non-routine observations and tasks as directed by the District Office.

(e) Test radio communication.

(f) Request assistance needed from the District Office to perform (a) through (e) above.

(2) Mississippi Headwaters Project Office

(a) Monitor telephones on a 24-hour basis.

(b) Place all personnel on standby for emergency duty if directed by District Office.

(c) Test radio communications.

(3) District Office

(a) Activate Emergency Operations Center.

(b) Attend telephones on 24-hour basis.

(c) Test radio communications.

(d) Place key staff on standby for emergency duty (Table A-1).

(e) Provide detailed instructions to the Park Manager for directing specific non-routine observations and tests.

(f) Dispatch personnel to dam site as required to provide expert evaluation of situation and to assist Park Manager as needed.

(g) Activate appropriate portions of Emergency Operations and Repair Subplan and Notification Subplan (Appendices B & C).

A-9. Subplan Maintenance

a. Updating

This subplan shall be updated as needed by the Dam Safety Officer, including;

(1) Annually.

(2) Whenever needed by modifications in instrumentation at or affecting the project, dam operating procedures, overall District emergency procedures, and/or changes of personnel.

b. Testing

The Chief, Project Operations Branch shall annually direct a thorough inspection of all mechanical, electrical, and other equipment pertinent to conduct of this subplan. The inspection shall include all tests, servicing and calibration necessary to ensure proper functioning.

c. Familiarization

The Dam Safety Officer shall ensure all pertinent Corps personnel are aware of and familiar with this subplan including:

(1) Circulation of each updated version for review and signature by pertinent District staff, the Mississippi Headwaters Project Office and the Sandy Lake Dam and Reservoir Project Office.

(2) Periodic review session with staff of the Water Control Center and Park Managers.

(3) Briefing, within two weeks of assuming duties, of all new Water Control staff.

(4) Briefing, before assumption of duties, of any new Park Manager.

TABLE A-1
Information on Key Contacts

PARTY	TELEPHONE NUMBER OFFICE	TELEPHONE NUMBER RESIDENCE	RADIO FREQUENCY	RADIO CALL LETTERS
DISTRICT PERSONNEL				
Resource Manager				
Donald Daly	(218)426-3482	(218)426-3482	SSB	WUD632
Mississippi Headwaters Project Office				
James Ruyak	(218)566-2306	(218)566-1294	SSB	WUD639
St. Paul District Office				
Emergency Operations Center[1]				
Twenty-four (24) hour telephone service. Must be kept informed of all pre-emergency or emergency situations. Also contact for matters involving national security, disasters, mobilization or NWS flood forecasts. Center will contact Dam Safety Officer, the Commander/District Engineer and NCD.				
District Emergency Operations Center	(612)220-0208		Contact Hastings Electronic Service Center at (612)437-2210(call letters - WUD6)	
David Christenson, Chief, Emergency Management	(612)220-0204	(612)690-5749		
Natural Disaster Planner	(612)220-0204			
Project Operations Branch				
Responsible for identifying a person-in-charge of the pre-emergency or emergency situation. Must be kept informed of all pre-emergency or emergency situations. Also contact for matters involving normal dam operations, and/or matters not covered by other District elements. Project Operations Branch will contact Dam Safety Officer for engineering and technical assistance and keep him informed of situation.			SSB(Primary 5040Khz) 1st Alternate-6020Khz LSB) (Emergency-5015Khz LSB)	
Dennis Erickson Chief, Natural Resource Management Section	(612)220-0325	(612)452-6850		
Thomas Oksness, Chief, Lock and Dam Section	(612)220-0322	(612)439-0272		
Dennis Cin, Chief, Project Operations Branch	(612)220-0320	(612)455-6786		
Dam Safety Officer				
To be informed of all pre-emergency or emergency situations. Responsible for identifying and/or providing the necessary engineering or technical support required to resolve the pre-emergency or emergency situation.				
Robert Post, Chief, Engineering Division	(612)220-0303	(612)437-1316		

TABLE A-1
Information on Key Contacts (continued)

PARTY	TELEPHONE NUMBER OFFICE	RESIDENCE	RADIO CALL LETTERS
Water Contol Center[3]			
For matters involving reservoir regulation.			
Edward Eaton, Water Control Center[1]	(612)220-0617	(612)731-9426	WUD613
Bonnie Montgomery, Water Control Center[1]	(612)220-0618	(612)450-0909	WUD613
Gordon Heitzman, Water Control Center[1]	(612)220-0620	(612)429-9500	
Kelsey Willis, Water Control Center[1]	(612)220-0619	(612)566-5022	
Helmer Johnson, Chief, Geotechnical,[1] Hydraulics & Hydrologic Engineering Branch	(612)220-0602	(612)633-7791	
Geotechnical Design Section[3]			
For matter involving the structural integrity of the dam			
W. Grant Westall, Geotechnical Design Section	(612)220-0644	(612)455-7632	
Helmer Johnson, Chief, Geotechnical Hydraulics & Hydrologic Engineering Branch	(612)220-0602	(612)633-7791	
Design Branch[3]			
For matters involving the structural integrity of the outlet structures.			
Marlin Munter, Chief, Design Engr. Section[1]	(612)220-0511	(612)784-6123	
Charles Spitzack, Chief, General Engr. Section[1]	(612)220-0512	(612)645-7301	
Robert Fletcher, Chief, Design Branch[1]	(612)220-0510	(612)484-4998	
Others[3]			
If none of the above can be reached.			
Dale Mazar, Chief, Project Management Br.[2]	(612)220-0444	(612)631-1940	
Wayne Knott, Chief, Environmental Resources Br.[2]	(612)220-0400	(612)739-2724	
Louis Kowalski, Chief, Planning Division[2]	(612)220-0307	(612)457-6453	
Ltc. David Nelson, Deputy Commander[2]	(612)220-0301	(715)247-5661	
Col. Joseph Briggs, District Commander[2]	(612)220-0300	(612)894-7142	
Aitkin County			
Civil Defense Director		(218)547-3300	(218)335-3902
Sheriff (24 hours)		(218)297-2138	
Emergency		911	
State of Minnesota			
Statewide Emergency Number	1-800-422-0798		
Metro Area	(612)649-5451		
Backup Only	(612)296-2100		
MN State Patrol[4]	(612)482-4901		

1 Call personnel in order listed until contact is made.
2 To be called in the order listed.
3 To be contacted if no contact can be made with other elements.
4 Potential Sources of Assistance in Communication.

EMERGENCY OPERATIONS AND REPAIR SUBPLAN

APPENDIX B

TO

EMERGENCY PLAN

FOR

SANDY LAKE DAM AND RESERVOIR

JUNE 1987

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EMERGENCY OPERATIONS AND REPAIR SUBPLAN

SANDY LAKE DAM AND RESERVOIR

B-1. Introduction

Conditions affecting operation of Sandy Lake Dam and Reservoir could result in a hazard to life and/or property due to high reservoir levels or sudden release of large volumes of water. Prompt conduct of emergency operations and repairs is essential for minimizing hazards to life and property.

a. Purpose

This subplan implements a portion of the Corps program to prepare emergency plans for all Corps dams. It establishes procedures for emergency operations and repairs to deal with impending and existing emergencies affecting the operation and safety of Sandy Lake Dam and Reservoir.

b. Scope

This subplan describes emergency operations and repairs to be implemented upon declaration of a pre-emergency or emergency condition. Operations and repairs are described for cases of:

(1) Excess seepage and/or malfunctioning of the dam's internal drainage system.

(2) Wave erosion and/or erosion of the downstream face of embankment.

(3) High reservoir level.

(4) Slope failure.

(5) Threatened sabotage.

(6) Sabotage.

c. Applicability

This subplan is applicable to all Corps elements and field offices concerned with operation of Sandy Lake Dam and Reservoir.

B-2. Definitions

a. Pre-emergency

A "pre-emergency" condition is one in which some impending or existing threat to the safe operation of the dam or reservoir is identified but no significant hazard to life or property is expected to occur.

b. Emergency

An "emergency" condition is one in which the occurrence of a significant hazard to life and/or property is possible or certain to occur. Conditions justifying declaration of an emergency condition may be imminent or longer term.

c. Park Manager

The term "Park Manager" means the dam tender or the individual in charge at the Sandy Lake project site.

d. Mississippi Headwaters Project Office

The term "Mississippi Headwaters Project Office" means the person in charge of the Mississippi Headwaters Project Office.

e. District

The term "District" means one of the following elements depending upon which is appropriate for the situation at hand.

(1) Dam Safety Officer. The Dam Safety Officer must be kept informed of all pre-emergency or emergency situations. Responsible for identifying and/or providing the necessary engineering or technical support required for the Pre-Emergency or emergency situation. Also responsible for keeping the Dam Safety Committee and the NCD Dam Safety Officer informed of the pre-emergency or emergency situation.

(2) Project Operations Branch. Responsible for identifying a person-in-charge of the pre-emergency or emergency situation. Responsible for keeping the Dam Safety Officer informed of the pre-emergency or emergency situation. Also, responsible for matters involving normal dam operations, and/or other matters not covered by the other District elements.

(3) Emergency Operations Center. Provides a 24-hour telephone contact with the District Office. Responsible for keeping Dam Safety Officer, the Commander/District Engineer, and

NCD in contact with the operations and personnel. Also responsible for matters involving national security, disasters, and mobilization.

(4) Water Control Center. Part of Hydrology Section in Geotechnical, Hydraulics and Hydrologic Engineering Branch. Responsible for matters involving reservoir regulation.

(5) Geotechnical Design Section. A section in Geotechnical, Hydraulics and Hydrologic Engineering Branch. Responsible for matters involving the structural integrity of the dam.

(6) Design Branch. Responsible for matters involving the structural integrity of the outlet structures.

(7) Project Management Branch. Responsible for management support.

(8) Planning Division. Responsible for management support, and matters involving environmental analysis and cultural resources.

B-3. Basis of Activation

This subplan is to be activated immediately upon declaration of a pre-emergency or emergency condition. See Appendix A, Emergency Identification Subplan, for procedure of declaring a pre-emergency or emergency condition.

B-4. Responsibilities

a. Park Manager

(1) Provide information to District on existing severity and rate of change of problem.

(2) Request needed assistance from the District including:

(a) Personnel, including expert supervision.

(b) Equipment.

(c) Materials.

(3) Carry out operations and repairs as directed by District.

(4) Act independently to implement emergency operations and repairs in the event communications with the District are disrupted or immediate action is required including:

(a) Deciding the urgency of correction.

(b) Carrying out appropriate portions of the Emergency Operations and Repairs Subplan.

(c) Obtaining needed personnel, equipment and materials (paragraphs B-5 and B-6).

b. Mississippi Headwaters Project Office

(1) Provide personnel, equipment and materials to Park Manager or as directed by the district.

(2) Direct emergency operations and repairs in the event communications between the Park Manager and District are disrupted.

c. District

(1) Assess problem and Park Manager's request for assistance with respect to:

(a) Urgency for correction.

(b) Type of corrective actions required.

(c) Personnel required for corrective actions including requirements for expert advice and/or on-site supervision.

(d) Equipment and materials required for corrective actions.

(2) Provide direction to the Park Manager on emergency operations and repairs to be carried out.

(3) Dispatch needed personnel, equipment and materials to the project from the District (paragraph B-5 and B-6).

(4) Arrange needed personnel, equipment and materials from sources other than District.

B-5. Emergency Operations and Repairs - Excess Seepage and/or Malfunctions of the Dam's Internal Drainage System

a. Potential Problems

Abnormal seepage may occur as rapid and/or significant increases in the amount of flow through the sand collection blanket or the seepage drains emptying into the outlet works; boils in the embankment or foundation; and creation of new seep areas on t downstream face of the

embankment, foundation, abutments or areas immediately downstream of the embankment. Seepage high on the face of the embankment, large amounts of seepage, and seepage carrying fines are especially serious. Boils and seep areas may also be caused by a malfunction of the dam's internal drainage system. Excess seepage problems are most likely to occur when the reservoir water level is at higher than normal elevation.

b. Corrective Action

Individual boils or small areas of seepage can be controlled on a temporary basis by ringing them with sandbags or other materials. Longer term control and control of large areas of seepage can be affected by covering the area with a 3 to 5 foot deep layer of granular material graded from coarse sands at the bottom to coarse gravels at the top. Lowering of the reservoir pool level reduces pressure on seepage areas and aids in control.

(1) Solutions to Combat Sandboils.

A sandboil may gradually undermine a dam and result in a failure by causing settlement and sloughing of the dam. As long as the flow is steady and not increasing, and no material is being carried, the danger is relatively small. In times of forecasted high water all locations of prior boils and any newly developed boils should be watched closely, especially those within 100 feet of the toe of the embankment. All boils should be conspicuously marked with flagging so that patrols can locate them without difficulty and observe changes in their conditions. A sandboil which discharges clear water in a steady flow is usually not dangerous to the safety of the dam. The only action necessary in this case is to drain the excess water off to prevent it from standing near the dam. However, if the flow of water increases and the sandboil begins to discharge material, corrective action should be undertaken immediately.

A common method of handling sandboils involves walling up a water tight sack ring around the boil until the water in the ring has attained sufficient head to counteract the head causing the boil. This is shown graphically on Plate B-1. Ringing boils with steel piling is shown on Plate B-2. It is not necessary or desirable to check the flow of water completely, as this may cause other boils to break out in the vicinity. It is necessary. however, to reduce the velocity of flow, and to stabilize the movement of sand, silt and other materials through which the water stream passes. A boil at the toe of the embankment is not necessarily more dangerous than one at a considerable distance landward from the toe.

(2) Solutions to Combat Seepage

Remedial measures to combat excessive embankment seepage

may be performed on either the upstream or downstream slopes.

(a) Downstream remedial work should allow the seepage water to flow as freely as possible while preventing migration or loss of existing soil materials from the embankment or foundation. If seepage causes sloughing of the landward slope, it should be flattened to a 1V to 5H slope or flatter. Since seepage on a slope indicates effective pervious embankment behavior or worse, material for flattening must be more pervious than the embankment material.

(b) The upstream treatment, when the seepage is heavy or the embankment shows signs of sloughing, would consist of banking or sandbagging the area under the pool with additional earth or other materials. This would minimize the entry of water into the foundation and/or the embankment.

(c) When water does seep through a foundation or embankment, material may be carried along with it, causing sink holes to appear in the embankment. These holes should be filled with sandbags or earthen material as soon as possible.

c. Resources Required

(1) Resources Required for Combating Seepage (Placing Granular Blanket).

(a) Materials

The characteristic of sand and gravel mixtures to allow the passage of water while at the same time preventing the passage of soil grains is extensively used in the design of water retaining structures. The properties of resistance to displacement by flowing water, resistance to wear from vehicular traffic, and the maintenance of strength and limited volume change over a large range of water contents make sand and gravel useful in providing surface protection to dams and canal banks. The wide range in gradation possible in sand and gravel mixtures, together with the wide range in structural materials to be protected, results in a wide range of acceptability for the materials used for sand and gravel or crushed rock blankets. The engineering properties and uses for various soil types are listed on Plates B-8 and B-9.

Natural sand and gravel deposits normally contain excessive amounts of sand. However, if these

materials are clean (contain less than 5 percent fines), almost any sand and gravel mixture can be used for downstream drainage blankets for earth dams by thickening the pervious blanket sufficiently so that seepage through the embankment and foundation can be carried within the blanket section. For some cases involving seepage through the foundation, it can be shown that the effective weight of the blanket must be equivalent to or greater than the total head in order to prevent rupturing boils or piping. Sometimes only 50 to 75 percent of the total head is required for effective weight of the blanket. For the pervious blankets between riprap and rolled earthfill, the requirements for the sand and gravel material become less critical as the thickness of the riprap layer increases. Generally, material from a natural deposit can be utilized if at least 50 percent of the material is in the gravel size range when riprap blankets of 3-foot normal thickness are specified. In those ranges of reservoir operation where anticipated wave action is comparatively rare, some relaxation of material requirements is also possible.

(b) Equipment

Placement of granular blankets requires equipment including:

(i) Dump trucks for transportation of materials to point of placement. The number of trucks required depends on the haul time and desired time of completion.

(ii) Tractors with blades for grading. One tractor is usually capable of grading up to about 500 square feet per hour.

(iii) Shovels and rakes for hand placement of materials.

(c) Personnel

In addition to drivers for trucks and other mechanized equipment, labor is required for various other tasks. The number of personnel required for this purpose depends on the size of the area being treated and desired speed of completion. Labor requirements for various tasks can be approximated from Tables B-1, B-2, and B-3 and Plate B-3.

(2) Resources Required For Ringing Boils

(a) Materials

Materials required for ringing boils include:

(i) Sandbags.

(ii) Sand.

(b) Equipment

Shovels are the only equipment required for ringing small boils. For larger areas of seepage, consideration should be given to use of a granular blanket. In the event larger areas must be treated by sandbagging, consideration should be given to use of transit concrete trucks, front end loaders or other mechanized equipment to fill and move bags. Typical sections for ringing boils are shown on Plates B-1 and B-2.

(c) Personnel

Curves to estimate the time (in hours) needed to place sandbags to construct various sizes of sandbag rings under various conditions are shown on Plate B-3.

(3) Lowering of Reservoir Pool Level

(See Section B-8.b.)

d. Technical Directions

(1) Placing Granular Blanket

A requirement of all blankets is careful placement. Requirements may vary widely according to the type and location of the blanket placement, but in every case uniformity and thickness are very important. (For additional information see Earth Manual, Reference 14). Blankets may be placed by the following methods:

(a) By the use of mobile dragline machines. Material may be obtained from the borrow pit or from trucks and dumped on the crown of the dam. The blanket should extend well above, below and to both sides of the affected area, and the material should be distributed as evenly as practical on both the downstream slope and berm. Dozers could be used to push the material from the abutments where turn around room may be available.

(b) By shoveling material by hand from trucks unloaded on the crown of the dam.

(c) Great care should be taken so that equipment loading does not cause failure of the dam.

(2) Ringing Boils

(a) Multiple nearby boils or soft areas in vicinity of boil should be included within sandbag ring.

(b) Build ring only high enough to slow water flow to point that no fines are carried. However, do not completely shut off the flow of seepage.

(c) Base of sandbag ring should be at least one and a half times the contemplated height. Typical sections for ringing boils are shown in Plates B-1 and B-2.

(3) Sandbags

Procedures for filling, handling, and placing sandbags are presented in Section B-6 of this report.

B-6. Emergency Operations and Repairs - Wave Damage and/or Erosion of the Downstream Face of the Embankment.

a. Potential Problems

Wave damage may occur during a period of high winds at the Dam and Reservoir. Damage may include displacement of riprap and/or erosion of the underlying materials causing collapse of the riprap. Wave damage is particularly serious during abnormally high reservoir pool levels when damaging erosion can cause a sudden collapse of the crest with subsequent overtopping of the embankment.

Description. Wave wash is the erosion of the upstream slope of the dam by wave action. This action may be caused by storms and shore winds and may be particularly dangerous on open reaches where the slope is not protected by riprap or timber and brush screens. Sand slopes and unsodded slopes are much more susceptible to wave wash than well-sodded slopes. Wave action may seriously damage a dam, particularly if the water surface is near the dam crown, if the reservoir pool is constant for a relatively long period of time, or if a slope is newly constructed or of sandy soil. Although the necessity for wave action protection cannot always be foreseen, the probable spots where wave wash might occur as known from past observations, will give a good idea of where material and supplies should be concentrated. Upon discovery of a damaged wave wash section or the beginning of wave wash damage, action should be taken to prevent further damage.

b. Corrective Action

The type of corrective action which is appropriate depends on the severity of damage, rate of progression of damage, and urgency of action. Temporary protection above and within 10-12 feet of the waterline can be provided quickly by use of plywood or canvas or polyethylene sheets or by filling eroded areas with sandbags. Placement of polyethylene sheets is illustrated in Plate B-4. Protection further below the water level can be provided by dumping riprap in the affected area. A strip of cotton or burlap bag over the affected area weighted down by sandbags is very effective in combating erosion. Sack revetment and construction of sandbag barriers are illustrated in Plates B-5 and B-6, respectively. In cases of severe erosion, lowering of the reservoir pool level can shift wave forces to a lower elevation. Repairs normally require reconstruction of the eroded slope and replacement of both bedding materials and riprap. Lowering of the pool level is usually required prior to making permanent repairs.

c. Resources Required

(1) Temporary protection with plywood

(a) Materials

(i) One-half inch exterior plywood

(ii) Concrete blocks or sandbags for use as weights

(iii) Stakes (2" x 4" x 3'-0")

(iv) 12 gauge galvanized tie wire

(v) Tie cord

(b) Equipment

(i) Sledge hammers

(ii) Wire cutters

(iii) Pike poles

(iv) Shovels

(v) Drill, 1/4"

(c) Personnel

The number of personnel required to put various areas of protection in place using plywood can be approximated from Plate B-7.

(2) Temporary Protection with Canvas

(a) Materials

(i) Wavewash canvas, 7' wide

(ii) Stakes (2" x 4" x 3'-0")

(iii) One and one-half inch pipe for bottom stiffener (20' lengths).

(iv) Concrete blocks or sandbags for use as weights.

(v) 12 gauge galvanized tie wire

(b) Equipment

(i) Sledge hammers

(ii) Wire cutters

(iii) Pike poles

(iv) Shovels

(c) Personnel

The number of personnel required to put various areas of temporary wave protection in place using canvas can be approximated by making assumptions using plate B-7.

(3) Temporary Protection with Sandbags

(a) Materials

(i) Sand

(ii) Sandbags

(b) Equipment

(i) Sack racks and stabilizing pins

(ii) Shovels

(iii) Cement transit trucks

(iv) Other trucks

(v) Wheelbarrows

(c) Personnel

The number of personnel required to fill and place sandbags can be approximated by assuming that under

average conditions with a crew of 2 to 10 men and 1 crew leader it would take four hours to place one cubic yard by hand at the place of filling. Also, see Table B-3 and Plate B-3.

d. Technical Directions

The construction of emergency protection projects is dependent on local working conditions, resources available, and the methods employed. The most efficient system of either mechanical or manual means of construction should be selected to meet the criteria of the emergency.

(1) Manual Labor

Manual labor can be a very effective way of accomplishing the necessary emergency tasks. Availability of a large work force or conditions that restrict the use of vehicles and/or mechanical devices, are examples of situations that lend themselves to the use of manual labor. The availability, need and use of manual labor should be given careful consideration ahead of time. Resources should be identified so that they can be quickly mobilized for an emergency.

(a) Sacking Operation

Sacks filled with earth material are suitable for almost every phase of emergency high water protection work. In many situations sacks provide the most practical and effective emergency deterrent. However, the labor force required (Plate B-3), duration of placement and cost, including purchase, filling, handling and removal should be considered, with discretion exercised so that the application of sacks is advantageous when compared to other methods.

(i) Filling Sacks

(aa) For seepage and sandboil control, a completely filled sack is detrimental. Instead a half filled sack should be used.

(bb) For wave erosion protection the sacks should be well filled and the material shaken down into the sack, but not tamped. A well-filled sack will measure approximately 12" x 24" x 8" and will contain 1 1/3 cubic feet of material, weighing about 130 pounds. Sacks for wave erosion protection should be sewn shut at the top.

(cc) The top of each sack can be loose, tied or sewn depending on the proposed use. If

large curved steel needles are not readily available for sewing the sacks, suitable needles can be made out of almost any kind of wood. The wooden needle should be about 7 inches long, whittled down to a diameter which will permit passage through the sack material - about 1/4 inch to 5/8 inch - with a large eye cut in one end and a point on the other. Any heavy twine is suitable for sewing the sacks.

(dd) When it is necessary to fill a large number of sacks in a short period of time, a sack rack should be used. One type of sack rack can be made by driving three stakes in the ground with their tops above the ground to the approximate height of the sack.

(ii) Transporting Sacks

Sacked material may be transported around the site in wheelbarrows, in handbarrows, or on people's shoulders.

(aa) Wheelbarrows are preferable as two filled sacks constitute a load for one wheelbarrow which can be handled by one person if smooth-run planks and a suitable grade are provided.

(bb) When necessary, filled sacks are transported on a person's shoulder, one sack per person.

(cc) Handbarrows, carried by two people, can be used to transport two sack loads over longer distances. A handbarrow may be made of two hand bars and two sacks. The hand bars are two poles about 5 feet long, from 1 1/2" to 2" in diameter. Any local wood that has sufficient strength is suitable. The handbarrow is assembled by slipping the hand bars through the bottom corners of an empty sack, taking care not to slit the openings in the sack larger than necessary. The second sack is slipped on in a similar manner, but in the reverse direction so that one sack is telescoped into the other. The sacks should be securely fastened to the hand bars by small nails.

(dd) Under certain situations, consideration should be given to filling sacks off site

and transporting them to the problem area by truck or perhaps on pads flown to the spot by cargo type helicopters. In instances where vehicles must be sent over roads that are impassable due to mud or sand, their safe passage may be provided by the use of a plank road. When travel or other satisfactory means of communication cannot be maintained, telephone communication should be provided along dangerous stretches of the dam.

(2) Mechanical Methods

If an emergency project is large and/or must be completed quickly, consideration should be given to the use of mechanical methods. They offer a versatile and effective way to construct emergency works in situations that require the rapid deployment of equipment and labor force in order to meet the urgent time requirements that emergencies demand.

(a) Mechanical Methods for Sacking

Sacking operations can be accelerated with the use of mechanical equipment. A small trenching machine can dig material and discharge it to the side. Another scheme would be to use a small dragline and combination hopper-belt conveyor so that sacks could be filled directly on trucks with a minimum of laborers required.

(b) Mechanical Tools to Speed Up Production

If conditions warrant, electric saws, air hammers, etc., could be used to speed up the mass production of such articles as cribs, board sections of movable wavewash protection and other earth retaining structures.

(c) Use and Planning of Mechanical Methods

The use of mechanical equipment calls for innovative and immediate decisions to ensure that the required emergency protective works are constructed as quickly as possible.

Repair procedures and where to obtain heavy equipment, tools, materials and other resources, should be given serious thought and action during nonflood seasons so that they can be carried out in the most efficient manner possible.

B-7. Emergency Operations and Repairs - Abutment, Foundation, or Embankment Failure

During periods of above normal pool, the abutments, foundation, and embankment should undergo close inspection. Also, after periods of high pool a close inspection should be made to assess significant changes in these features. Notification of any potential pre-emergency conditions or emergency conditions should be immediately made following the guidance in Appendix C.

B-8. Emergency Operations and Repairs - High Reservoir Level

a. Potential Problems

High reservoir levels cause large hydrostatic forces on the dam, reduce freeboard available to contain wave action and reduce the capability of the dam to impound major inflows without overtopping or uncontrolled spillway flow. High reservoir levels contribute to excess seepage, piping, wave erosion and other safety problems. High water levels can also result in property damage and creation of safety problems around the periphery of the lake.

b. Corrective Action

The only corrective action for high water levels is increasing releases. When the spring ice breakup begins, the outflow is regulated so that water levels from Sandy Lake, Pokegama Reservoirs and at Aitkin result in elevations that correspond to the guide curves for spring and summer floods (Figures B-1 and B-2). If the pool continues to rise above 1216.31, the desired summer level, flood damage within the reservoir and downstream conditions govern the amount of discharge. The situation at stations on the Mississippi River from Aitkin to the Twin Cities is considered in determining the outflow. If protection from flooding is needed at any of these stations, the inflows are stored as necessary until the maximum and ordinary regulating limit, elevation 1218.31, is reached. At this elevation, set the discharge equal to inflow. At this point, if inflow exceeds the dam capacity, the dam is completely opened and open river conditions exist until the pool level falls below elevation 1218.31 and regulation becomes possible again. Discharge is governed by damage within the reservoir and downstream conditions until the spring breakup is completed.

B-9. Emergency Operations and Repairs - Slope Failure

a. Potential Problems

Slope failure may occur as the mass movement of a portion of the embankment. Such failures weaken the dam, and if located sufficiently high on the embankment may cause a breach, or lead to collapse of the dam crest. Slope failures of any significant magnitude are serious and require immediate corrective action and notification of proper personnel

according to Appendix C.

b. Corrective Action

(1) Lowering of the upstream pool should be done in the event of any slope failure that is sufficiently serious to threaten the safety of the dam or dike areas. (See Reservoir Regulation Manual, Reference 11).

(2) Immediate treatment of slope failures consists of filling slide areas with riprap, sandbags or a granular blanket. The preferred method depends on materials and labor available and the urgency of action. When the urgency of the situation permits, filling of slide areas will be carried out under supervision of District staff and constitute rebuilding of the affected portion of the embankment. Immediate treatment in urgent situations will consist of filling slide areas with sandbags, riprap or other available materials. The methods used would be the same as those discussed in Section B-5 and B-6.

B-10. Emergency Operations and Repairs - Threatened Sabotage

a. Potential Problems

Threats of sabotage are most likely to be received from individuals or groups whose actual intent of carrying through with the threatened action is not known. However, all such threats are to be taken seriously. Threats considered most probable to occur are those related to disruption of communications, blocking access to the project, and interference with project operations. Threats could also relate to damaging the embankment or other key project features affecting safety.

b. Corrective Action

(1) All threats concerning the Sandy Lake Dam and Reservoir will be reported immediately to the Federal Bureau of Investigation and to the District's Hydraulics and Hydrology Branch. Others should be notified according to Appendix C.

(2) Immediate assistance to secure and protect the dam, dikes and appurtenant facilities will be requested in the event a threatened action could jeopardize the safety of project visitors and staff or downstream areas if carried out. Agencies from which law enforcement assistance can be obtained are listed in Table C-2.

(3) Every effort shall be made to operate the Sandy Lake Dam and Reservoir so as to avoid injury to all parties. However, the possible catastrophic consequences of dam

failure require that actions necessary to maintain the safety of the dam must not be compromised by persons seeking to block access to the site, limit reservoir levels or releases, or otherwise impede essential operations.

B-11. Emergency Operations and Repairs - Sabotage

a. Potential Problems

Acts of sabotage may range from minor disruptions to quasi-military attacks by knowledgeable and well-equipped professionals. The effects of sabotage fall into one of three categories: a) not affecting safety of the dam; b) posing a minor or future safety problem; or c) posing an immediate, serious safety problem.

b. Corrective Actions

(1) All acts of sabotage will be reported immediately to the Federal Bureau of Investigation and to the District's Hydraulics and Hydrologic Engineering Branch.

(2) Immediate remedial action shall be initiated in all cases of sabotage causing an imminent or future safety problem of a serious nature. As appropriate, remedial action shall include:

(a) Declaration of an emergency condition and activation of the Notification Subplan (Appendix C).

(b) Activation of the emergency drawdown.

(c) Initiation of emergency repairs according to the nature of damage.

B-12. Inventory of Resources

Resources available at the District level for carrying out emergency operations and repairs are listed in Table B-4. An inventory of available contractors and vendors at the Project Office level is shown on Table B-5.

TABLE B-1

EMERGENCY LABOR REQUIREMENTS - EARTH FILL STRUCTURES [1/]

WORK ELEMENT DESCRIPTION	UNIT	WORKER-DAYS PER UNIT		
		ADVERSE CONDITION	AVERAGE CONDITION	FAVORABLE CONDITION
Excavate and Load	1000 CY	11.2	6.9	2.5
Hauling	1000 YD MI	5.2	3.1	1.4
Spreading and Compacting	1000 CY	18	9	4
Erosion Control: Riprap (12" thick)	1000 CY	22.85	15.0	7.5
For Quick Estimates: Earth fill structure, complete [2/].	1000 CY	54	35	15

Typical crews: 1 crew leader, 3 to 5 laborers plus equipment for clearing and grubbing; 1 worker with equipment excavating and loading; 5 to 15 workers with equipment hauling; 1 crew leader and 3 to 7 laborers spreading and compacting fill; 1 crew leader and 5 to 10 laborers installing erosion control plus equipment and workers hauling materials.

1/ Reference (14)- FM 5-35, Table 16-21.
2/ Includes all clearing, borrowing, hauling, compacting and erosion control.

TABLE B-2

EMERGENCY LABOR REQUIREMENTS - EROSION CONTROL [1/]

WORK ELEMENT DESCRIPTION	UNIT	WORKER DAYS PER UNIT ADVERSE CONDITION	AVERAGE CONDITION	FAVORABLE CONDITION
Machine Work:				
Sloping shoulders, banks and ditches	1000 SY YD MI	4.0	2.6	1.3
Hauling riprap or rubble	1000 YD MI	5.2	3.1	1.4
Placing riprap or rubble (12" thick)	1000 CY	18	12	6
Hand Work:				
Sloping shoulders banks and ditches	1000 SY	33	22	11
Placing riprap or rubble	SY	0.09	0.06	0.03
For quick estimates:				
Erosion control - riprap (12" thick)	1000 SY	22.5	15.0	7.5

Typical crew: Sloping shoulders, banks and ditches - 1 to 2 operators on equipment, or 1 crew leader and 3 to 8 laborers with hand tools.

Typical crew: Grass - 1 crew leader, 6 to 20 laborers plowing, harrowing, fertilizing, digging sprigs, hauling sprigs, scattering sprigs, disking, seeding and watering.

Typical crew: Riprap - 1 crew leader and 6 to 20 laborers hauling and placing riprap.

[1/] Reference (14) - FM 5-35, Table 16-42.

TABLE B-3

EMERGENCY LABOR REQUIREMENTS - GENERAL EXCAVATION [1/]

WORK ELEMENT DESCRIPTION	UNIT	WORKER - DAYS PER UNIT		
		ADVERSE CONDITION	AVERAGE CONDITION	FAVORABLE CONDITION
Machine Work:				
Excavating (no trim nor handwork)	1000 CY	25	12	6
Loading	1000 CY	9.0	4.5	2.0
Hauling	1000 YD MI	5.2	3.1	1.4
Spreading	1000 CY	4.9	3.0	1.5
Backfilling	1000 CY	9	6	3
Compacting	1000 CY	12	8	4
Grading	1000 CY	1.6	0.8	0.4
Handwork:				
Excavating	CY	1.2	0.7	0.3
Loading	CY	0.8	0.4	0.2
Spreading	CY	0.18	0.12	0.06
Backfilling	CY	0.35	0.20	0.10
Compacting	CY	0.35	0.35	0.15
Shoring Walls of Excavation	1000 SF	40	24	9

Typical crew: Machine work - 1 crew leader, 2 operators excavating, 2 to 6 operators on hauling equipment, 1 operator on spreading and backfilling equipment; 1 operator on compacting equipment, and 1 operator on grading equipment.

Typical crew: Handwork - 1 crew leader, 2 to 10 workers excavating, loading, spreading backfilling, compacting, trimming, and fine grading.

Typical crew: Shoring - 2 or more workers.

[1/] Reference (14) - FM 5-35, Table 16-20.

TABLE B-4

INVENTORY OF RESOURCES - DISTRICT LEVEL

Name of Resource	Type of Resource	Address	Phone Number
Brisson Pump Company	Pump Distributor	2359 E. Cowern Place N. St. Paul, MN 55109	(612) 777-3317
Tecumseh Products Company	Pump Distributor	P.O. Box 355 223 Curtis Street Delaware, OH 43015	(614) 369-9656
Kasten Schmidt Equipment Systems	Pump Distributor	455 Whitrock Avenue Wisconsin Rapids, WI 54494	(715) 423-9221
The Crisafulli Pump Company, Inc.	Pump Distributor	Box 1051 Glendive, MT 59330	(406) 365-3393
Gator Pump, Inc.	Pump Distributor	P.O. Box 57 302 Corrigan Brownwood, TX 76801	1-800-351-1463
Cherne Industries, Inc.	Sewer Plugs/ Pipe Stoppers	5701 S. County Road 18 Minneapolis, MN 55436	(612) 933-5501
NB Products	Sewer Plugs/ Pipe Stoppers	35 Bevlah Road New Britain, PA 18901	(215) 345-1879
Goodyear Tire and Rubber Company	Sewer Plugs/ Pipe Stoppers	5100 West 35th Street Minneapolis, MN 55416	(612) 927-7381
Carlson Equipment Company	Sewer Plugs/ Pipe Stoppers	1380 W. County Road C St. Paul, MN 55113	(612) 633-8171

TABLE B-4 (Continued)

INVENTORY OF RESOURCES - DISTRICT LEVEL

Name of Resource	Type of Resource	Address	Phone Number
Mac Katz Bag Co., Inc (includes polythylene sheeting)	Sandbags	P.O. Box 1666 Indianapolis, IN 46206-1666	(317) 635-9561
Independent Manufacturers Marketing Service	Sandbags	1543 Holton Street St. Paul, MN 55108	(612) 644-2007
Berg Bag Company	Sandbags	410 3rd Avenue North Minneapolis, MN 55401	(612) 922-3286
Volm Bag Company	Sandbags	2200 Mary Hills Drive Golden Valley, MN 55345	(612) 935-8222
Central Bag Company	Sandbags	1323 W. 13th St. P.O. Box 4044 Kansas City, MO 64101	(816) 471-0388
Dan-Dee Equipment, Inc.	Sandbagging Equipment	P.O. Box 125 Honey Creek, WI 53138	(414) 534-3138
Bemis Company, Inc. Packaging Service	Sandbagging Equipment	315 27th Ave N.E. Minneapolis, MN 55418	

TABLE B-5

INVENTORY OF LOCAL CONTRACTORS AND VENDORS - PROJECT OFFICE LEVEL

NAME OF CONTRACTOR/VENDOR	TYPE OF SERVICE	ADDRESS/PHONE NUMBER
Casper Construction Co., Inc.	Contractor	212 SE 10th Street Grand Rapids, Minnesota 55744 (218) 326-9637
Hawkinson Construction Co., Inc.	Contractor	1714 NW 3rd Street Grand Rapids, Minnesota 55744 (218) 326-3569
Eagle Contracting Company	Contractor	Remer, Minnesota 56672 (218) 566-1454
Peterson Excavating, Inc.	Excavation	Federal Dam, Minnesota 56641 (218) 654-5282

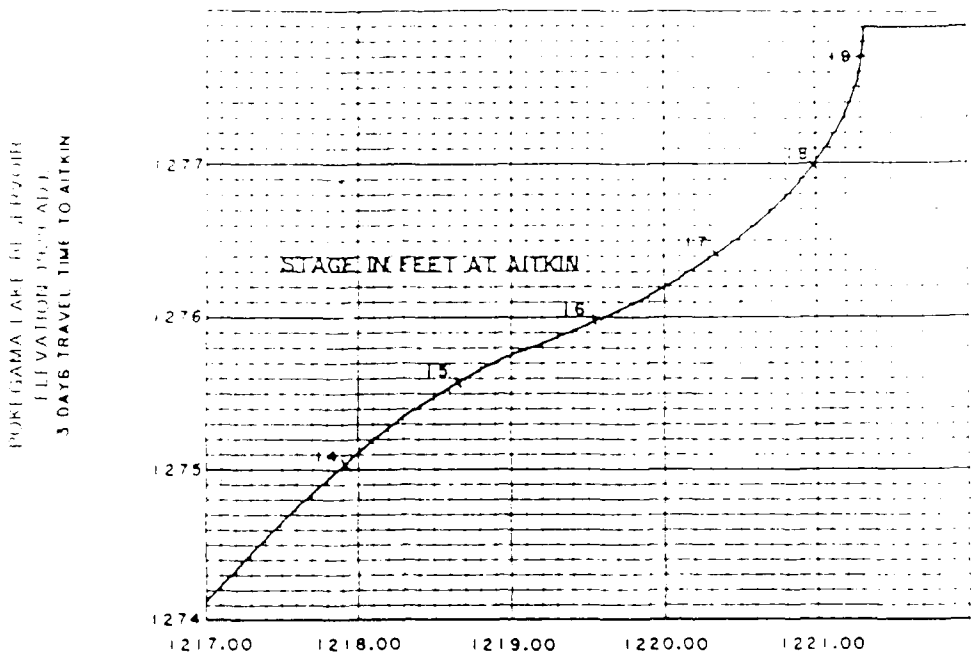
INVENTORY OF RESOURCES AVAILABLE AT PROJECT OFFICE

CONTRACTORS

Nistler Construction, McGregor, MN Phone (218) 768-2731
Boelter Construction, McGregor, MN Phone (218) 426-3498
Ammala Construction, McGregor, MN Phone (218) 768-3468
Serfling Excavation, McGregor, MN Phone (218) 426-3547

EQUIPMENT

Ford 3400 tractor W/front end loader
Onan trailer generator
Chev 3/4 ton truck 4 wheel drive
Sheriff's radio
2 Handi talkies
Mobile truck and stationary radio
2 16 foot boats with 10 h.p. motors
1 17 foot boat with 90 h.p. motor
1 Homelite pump 1½ in.
1 3 in. western pump
1 300 gal. water tank W/trailer
Arc and Acetylene welders
7 pair hip boots
6 hard hats
Misc. hand tools



SANDY LAKE RESERVOIR
ELEVATION 1929 ADJ.

NOTE:

Curve shows relation between maximum reservoir stages and corresponding peak flood stage on the Mississippi River at Aitkin which, under operating procedures now in effect, will result (on the average) in the minimum total flood damages to affected interests in the three principal damage areas.

AITKIN GAGE ZERO = 1182.41
POKEGAMA GAGE ZERO = 1264.42
SANDY GAGE ZERO = 1207.31

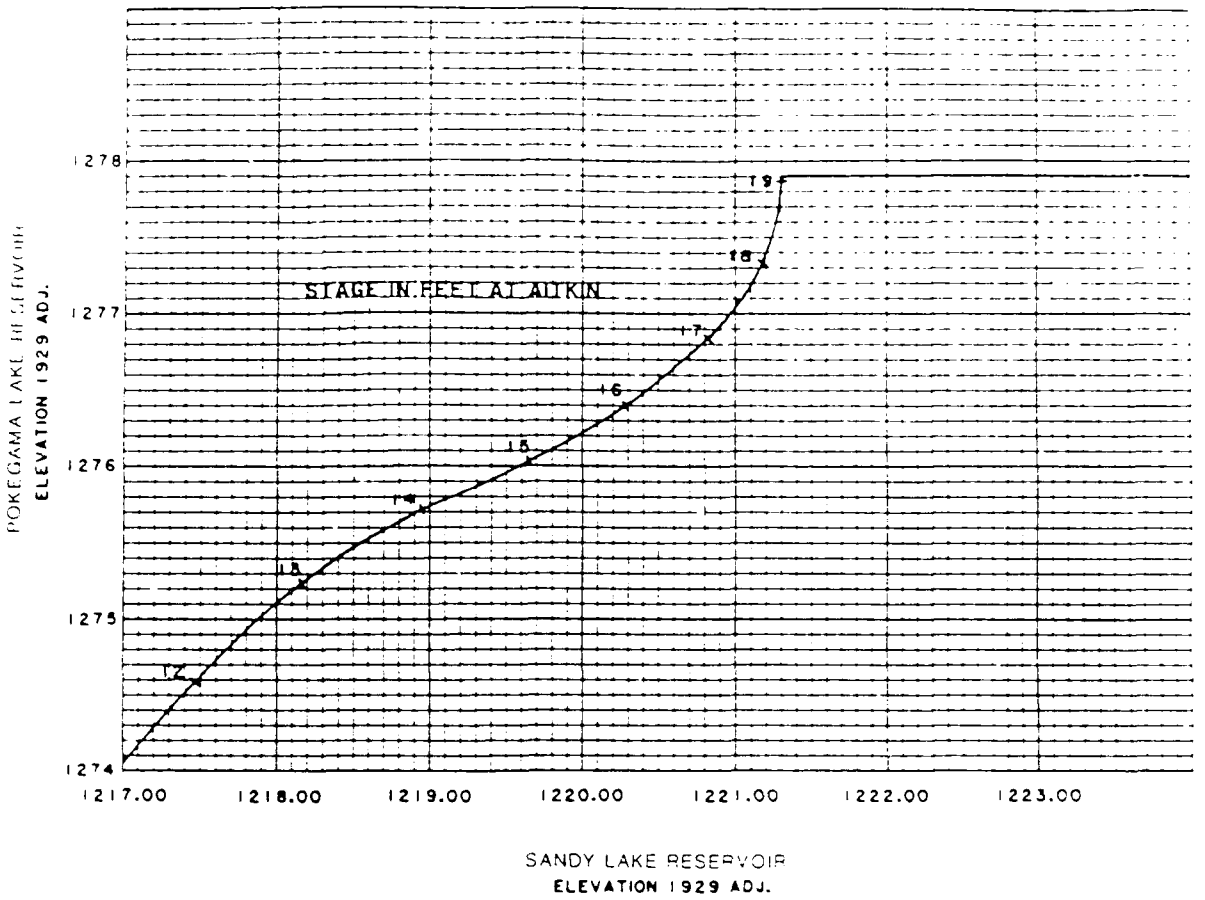
1 DAY TRAVEL TIME TO AITKIN FROM SANDY LAKE

3 DAYS TRAVEL TIME TO AITKIN FROM POKEGAMA RESERVOIR

SPRING FLOOD GUIDE CURVE (MARCH-15 MAY)

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

FIGURE B-1



NOTE:

Curve shows relation between maximum reservoir stages and corresponding peak flood stage on the Mississippi River at Aitkin which, under operating procedures now in effect, will result (on the average) in the minimum total flood damages to affected interests in the three principal damage areas.

AITKIN GAGE ZERO = 1182.41
POKEGAMA GAGE ZERO = 1264.42
SANDY GAGE ZERO = 1207.31

1 DAY TRAVEL TIME TO AITKIN FROM SANDY LAKE

3 DAYS TRAVEL TIME TO AITKIN FROM POKEGAMA RESERVOIR

SUMMER FLOOD GUIDE CURVE
(15 MAY-SEPT)

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

FIGURE B-2

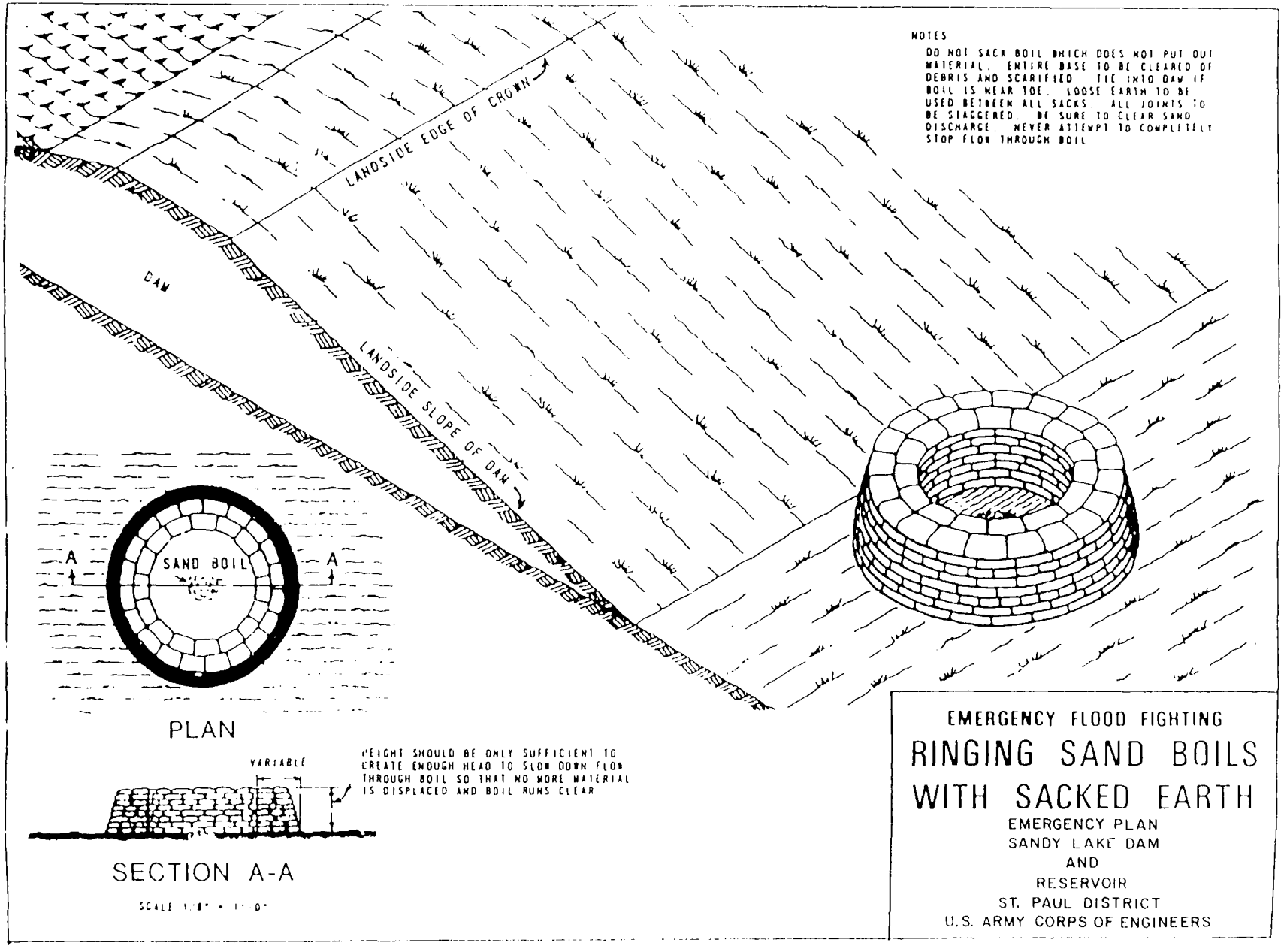

NOTES
DO NOT SACK BOIL WHICH DOES NOT PUT OUT MATERIAL. ENTIRE BASE TO BE CLEARED OF DEBRIS AND SCARIFIED. TIE INTO DAM IF BOIL IS NEAR TOE. LOOSE EARTH TO BE USED BETWEEN ALL SACKS. ALL JOINTS TO BE STAGGERED. BE SURE TO CLEAR SAND DISCHARGE. NEVER ATTEMPT TO COMPLETELY STOP FLOW THROUGH BOIL
LANDSIDE EDGE OF CROWN
DAM
LANDSIDE SLOPE OF DAM
A
SAND BOIL
A
PLAN
VARIABLE
WEIGHT SHOULD BE ONLY SUFFICIENT TO CREATE ENOUGH HEAD TO SLOW DOWN FLOW THROUGH BOIL SO THAT NO MORE MATERIAL IS DISPLACED AND BOIL RUNS CLEAR
SECTION A-A
EMERGENCY FLOOD FIGHTING
RINGING SAND BOILS WITH SACKED EARTH
EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

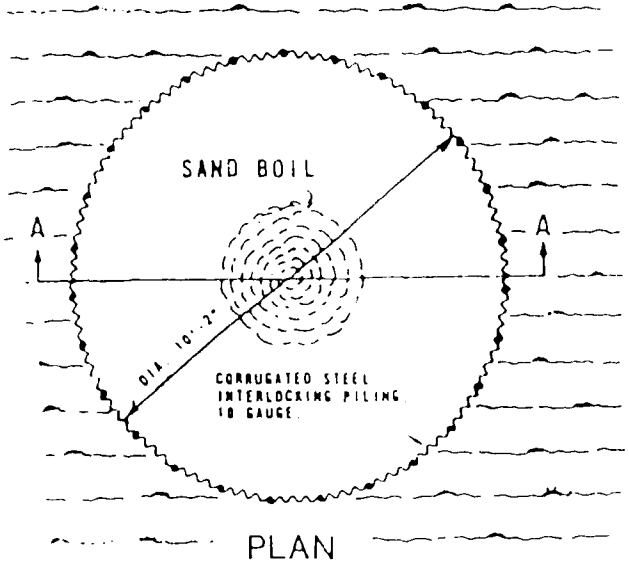
PLATE B-1

EMERGENCY FLOOD FIGHTING

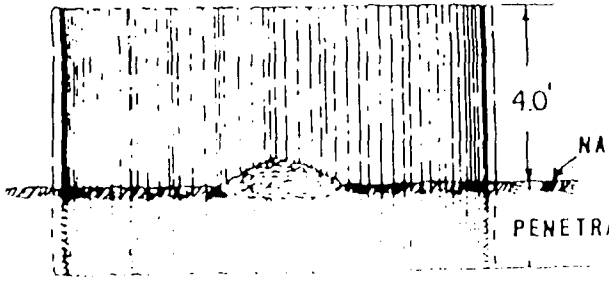
RINGING SAND BOILS WITH STEEL PILING

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

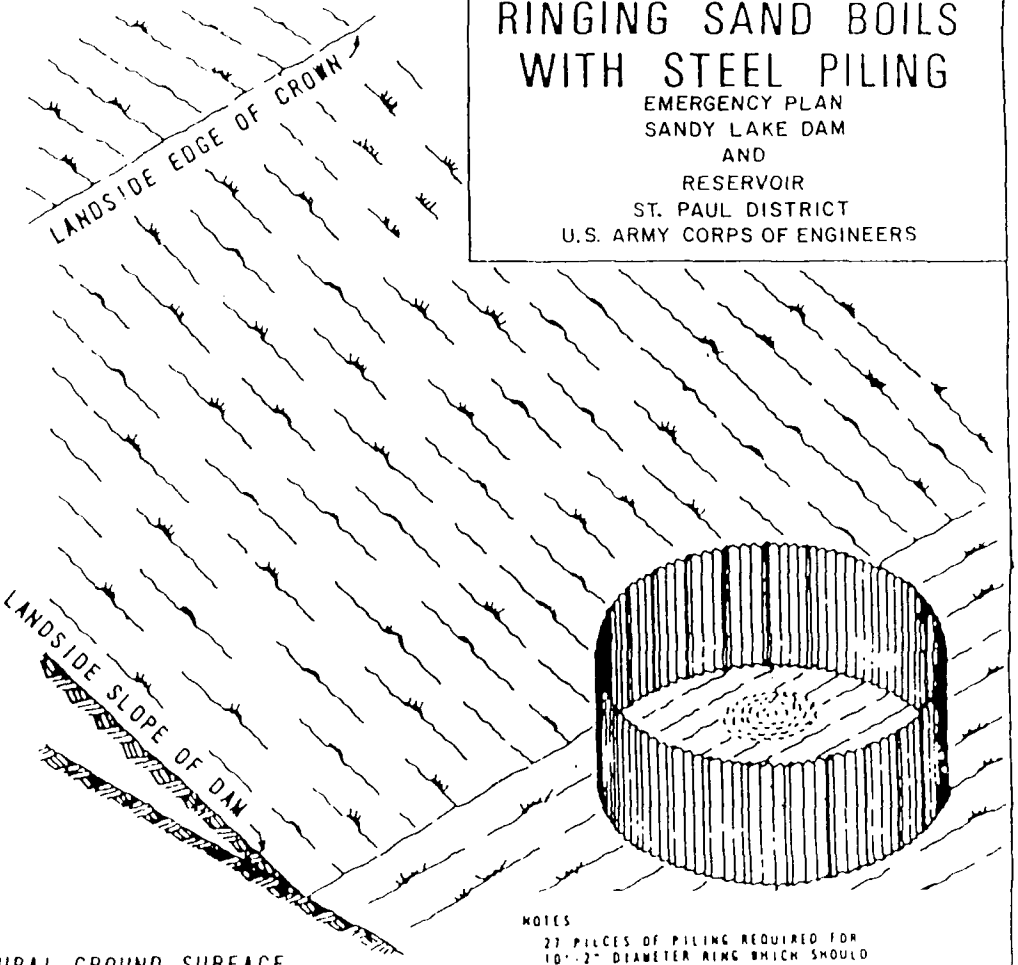
NOTE
DRIVING CAPS WILL BE USED. DRIVING MAY BE EFFECTED EITHER BY MECHANICAL OR HAND METHOD.



PLAN



SECTION A-A



NOTES
27 PIECES OF PILING REQUIRED FOR 10'-2" DIAMETER RING WHICH SHOULD BE ADEQUATE FOR MOST SAND BOILS
DO NOT RING BOIL WHICH DOES NOT PUT OUT MATERIAL
ENTIRE AREA TO BE CLEARED OF DEBRIS
BE SURE TO CLEAR SAND DISCHARGE
NEVER ATTEMPT TO COMPLETELY STOP FLOW THROUGH BOIL

PLATE B-2

TIME REQUIRED TO CONSTRUCT SANDBAG RINGS OF VARIOUS SIZES

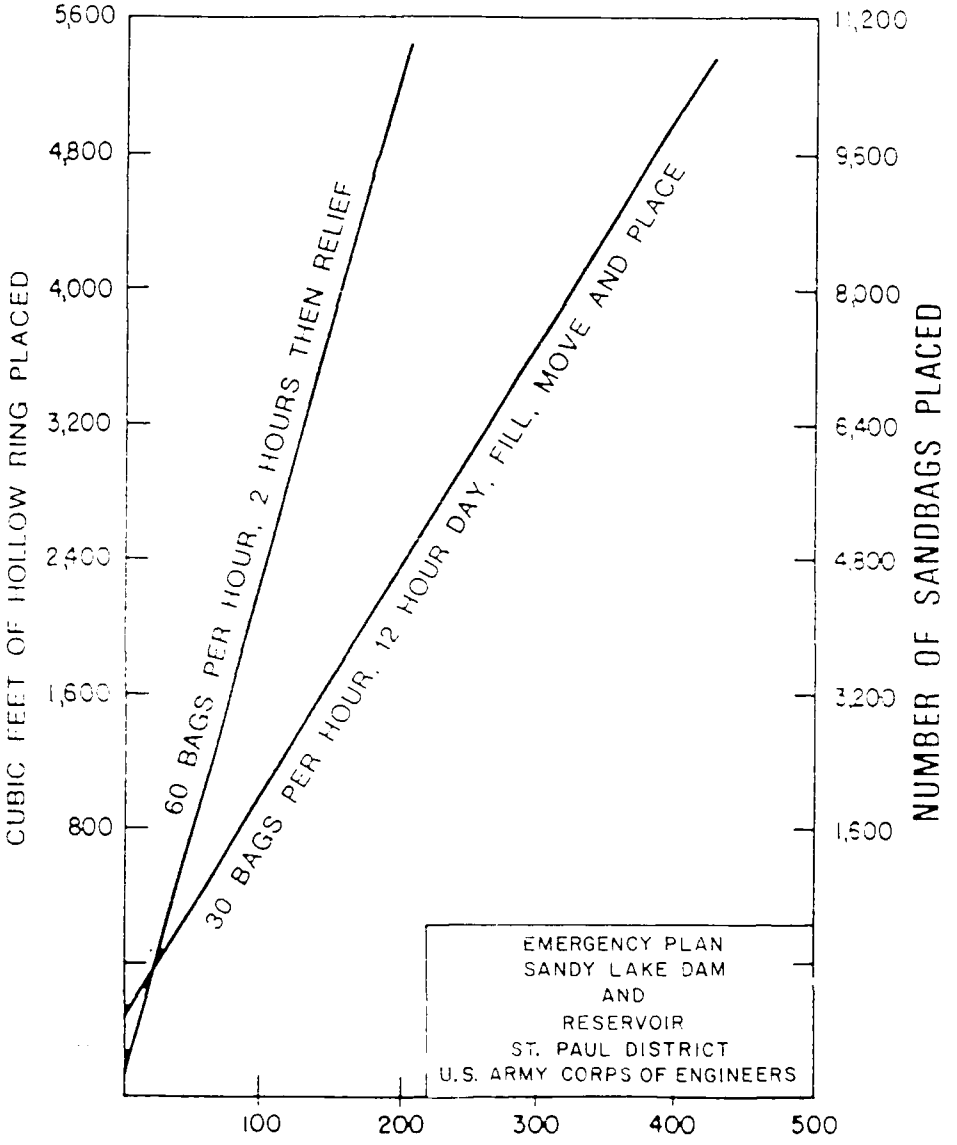
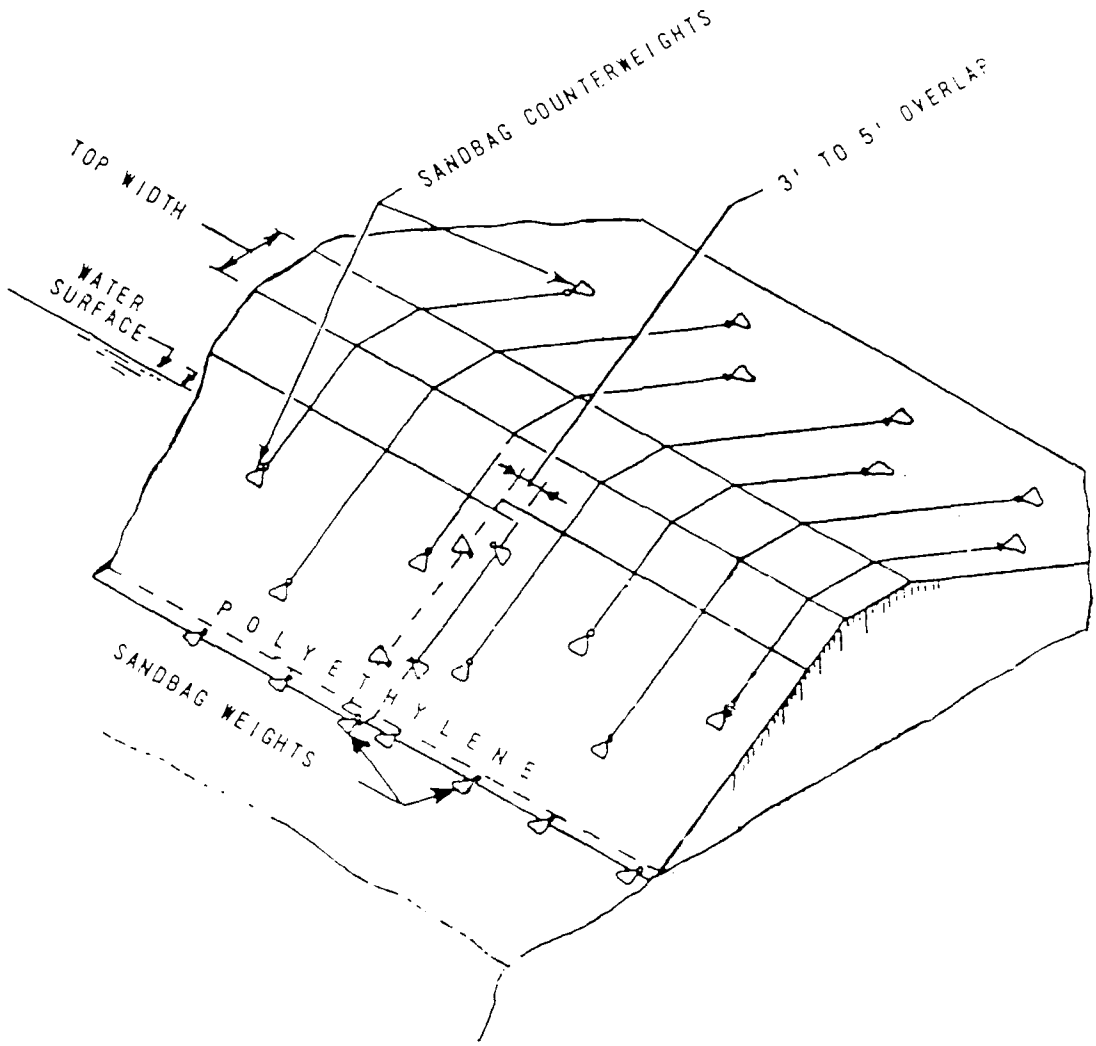


PLATE B-3



EMERGENCY FLOOD FIGHTING

PLACEMENT OF POLYETHYLENE SHEETING IN THE WET

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE B-4

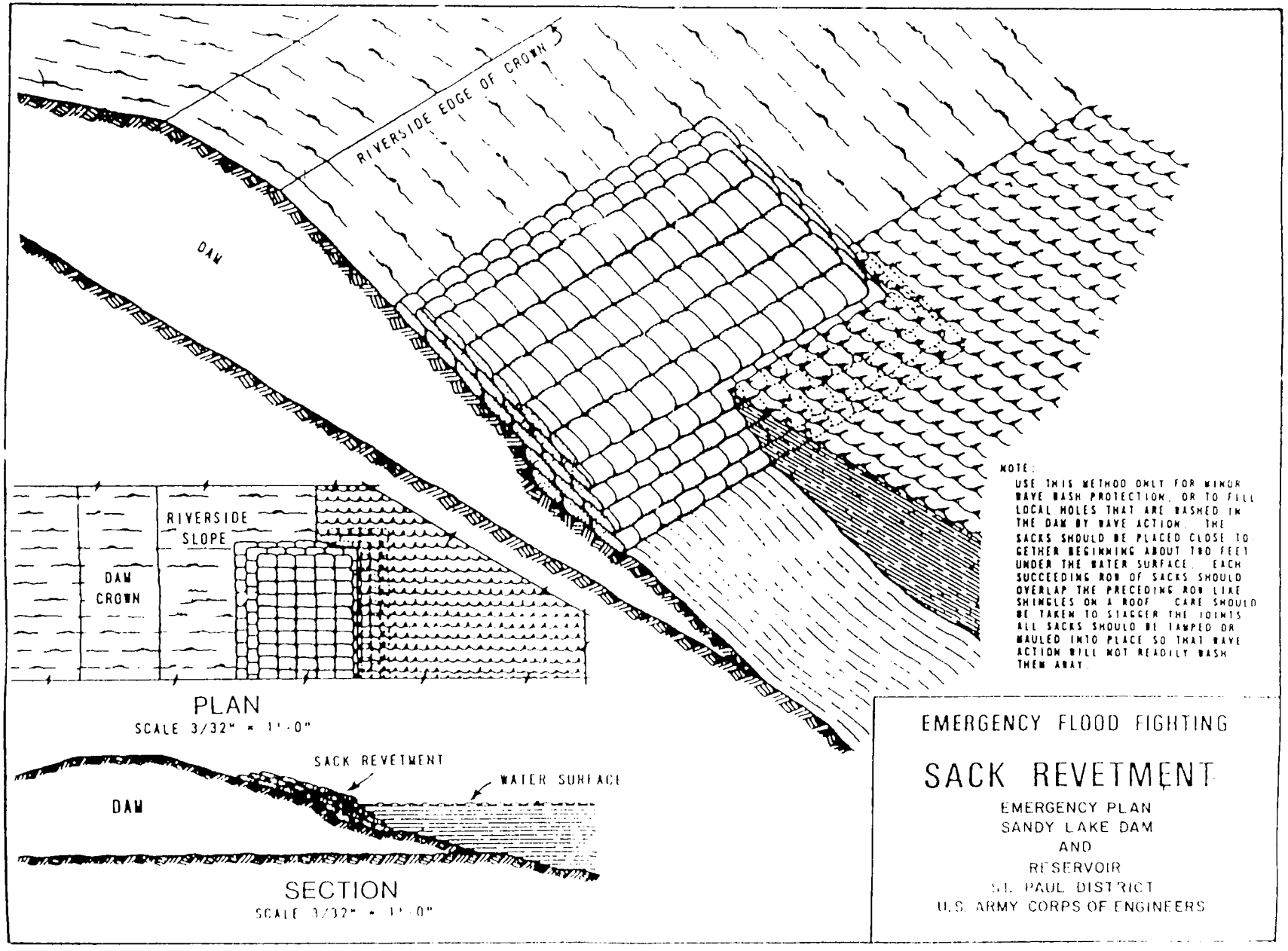
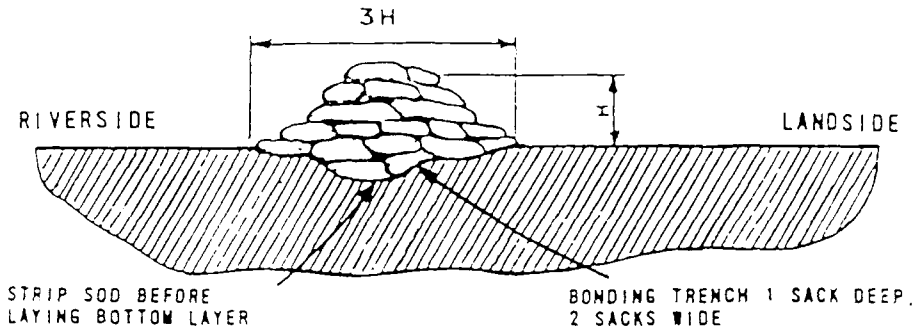

RIVERSIDE EDGE OF CROWN
DAM
RIVERSIDE SLOPE
DAM CROWN
PLAN
SCALE 3/32" = 1'-0"
SACK REVETMENT
WATER SURFACE
DAM
SECTION
SCALE 3/32" = 1'-0"
NOTE:
USE THIS METHOD ONLY FOR MINOR WAVE WASH PROTECTION, OR TO FILL LOCAL HOLES THAT ARE WASHED IN THE DAM BY WAVE ACTION. THE SACKS SHOULD BE PLACED CLOSE TO GETHER BEGINNING ABOUT TWO FEET UNDER THE WATER SURFACE. EACH SUCCEEDING ROW OF SACKS SHOULD OVERLAP THE PRECEDING ROW LIKE SHINGLES ON A ROOF. CARE SHOULD BE TAKEN TO STAGGER THE JOINTS ALL SACKS SHOULD BE TAMPED OR MAULED INTO PLACE SO THAT WAVE ACTION WILL NOT READILY WASH THEM AWAY.
EMERGENCY FLOOD FIGHTING
SACK REVETMENT
EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE B-5



SECTION

NOTE:

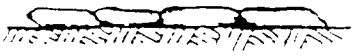
ALTERNATE DIRECTION OF SACKS WITH BOTTOM LAYER PARALLEL TO FLOW, NEXT LAYER PERPENDICULAR TO FLOW, ETC.

LAP UNFILLED PORTION UNDER NEXT SACK.

TYING OR SEWING SACKS NOT NECESSARY.

TAMP THOROUGHLY IN PLACE.

SACKS SHOULD BE APPROXIMATELY 1/2 FULL OF SAND.

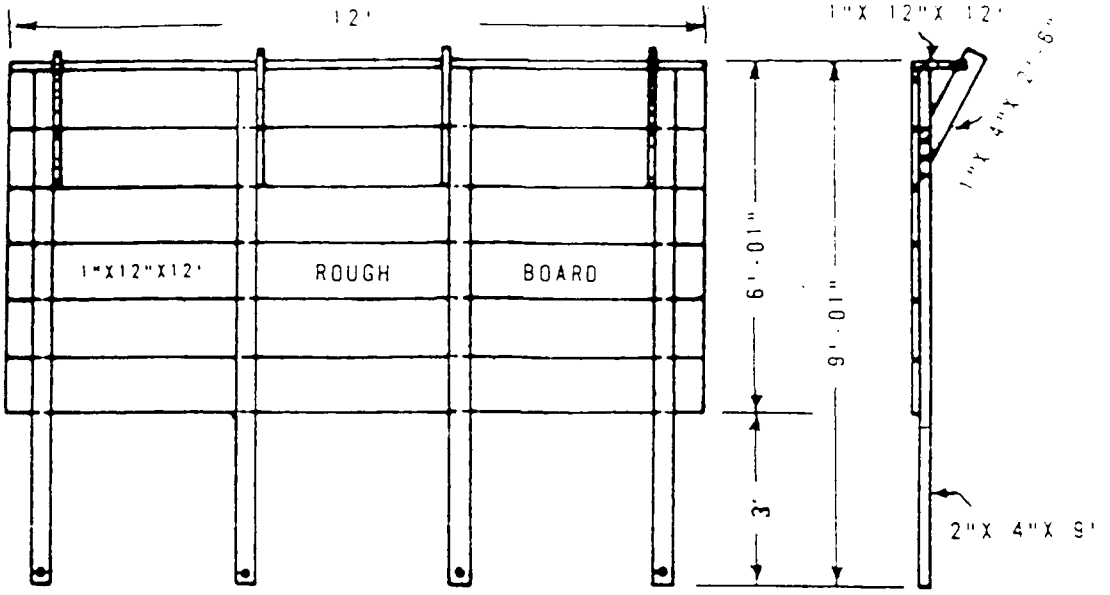


METHOD OF LAPPING SACKS

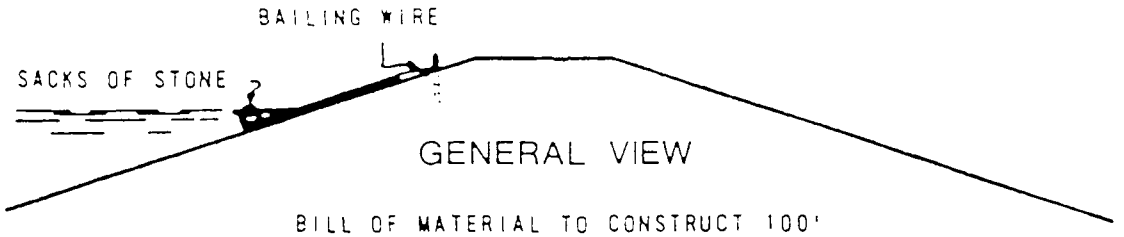
EMERGENCY FLOOD FIGHTING

SANDBAG BARRIER

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS



PLAN ELEVATION



GENERAL VIEW

BILL OF MATERIAL TO CONSTRUCT 100'

56 PCS. 1"X 12"X 12'	32 PCS. 1"X 4"X 2'-6"
32 PCS. 2"X 4"X 9'	32 PCS. 2"X 4"X 2'

PERSONNEL REQUIRED FOR PLACING PLANKS -
4.2 - 5.8 WORKERS HOURS PER 100 SQUARE FEET.

EMERGENCY FLOOD FIGHTING

TYPE OF MOVABLE WAVE WASH PROTECTION

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE B-7

ENGINEERING PROPERTIES OF VARIOUS SOIL TYPES[1]

Typical Names of Soil Groups	Group Symbols	Important Properties			
		Permeability when Compacted	Shearing Strength when Compacted and Saturated	Compressibility when Compacted and Saturated	Workability as a Construction Material
Well-graded gravels, gravel-sand mixtures, little or no fines	*GW*	pervious	excellent	negligible	excellent
Poorly graded gravels, gravel-sand mixtures, little or no fines	*GP*	very pervious	good	negligible	good
Silty gravels, poorly graded gravel-sand-silt mixtures	*GM*	semipervious to impervious	good	negligible	good
Clayey gravels, poorly graded gravel-sand-clay mixtures	*GC*	impervious	good to fair	very low	good
Well-graded sands, gravelly sands, little or no fines	*SW*	pervious	excellent	negligible	excellent
Poorly graded sands, gravelly sands, little or no fines	*SP*	pervious	good	very low	fair
Silty sands, poorly graded sand-silt mixtures	*SM*	semipervious to impervious	good	low	fair
Clayey sands, poorly graded sand-clay mixtures	*SC*	impervious	good to fair	low	good
Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	*ML*	semipervious to impervious	fair	medium	fair
Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	*CL*	impervious	fair	medium	good to fair
Organic silts and organic silt-clays of low plasticity	*OL*	semipervious to impervious	poor	medium	fair
Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	*MH*	semipervious to impervious	fair to poor	high	poor
Inorganic clays of high plasticity, fat clays	*CH*	impervious	poor	high	poor
Organic clays of medium to high plasticity	*OH*	impervious	poor	high	poor
Peat and other highly organic soils	*Pt*	—	—	—	—

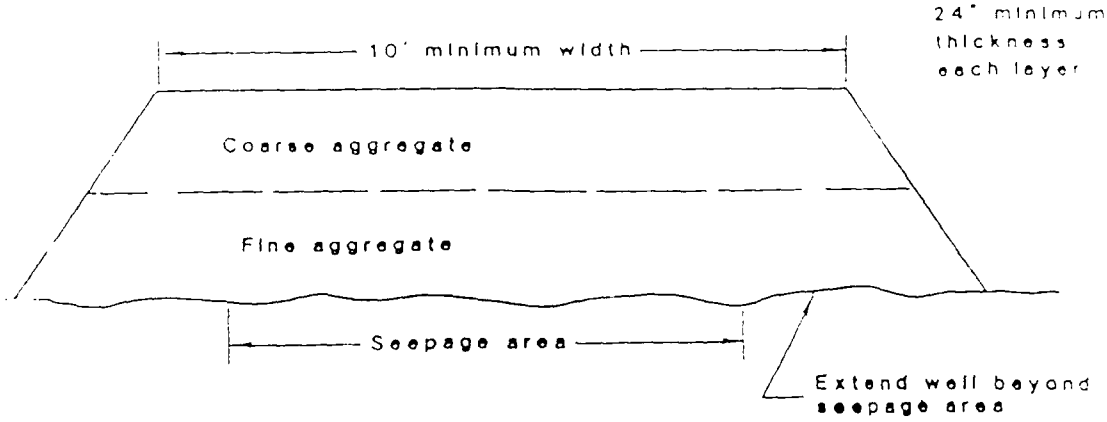
1. Reference (15) - Soil Mechanics, Lambe T. W. and R. V. Whitman

USES OF VARIOUS SOIL TYPES[1]

Typical Names of Soil Groups	Group Symbols	Relative Desirability for Various Uses									
		Rolled Earth Dams			Canal Sections		Foundations		Roadways		
									Fills		
		Homogeneous Embankment	Core	Shell	Erosion Resistance	Compacted Earth Lining	Seepage Important	Seepage not Important	Frost Heave not Possible	Frost Heave Possible	Surfacing
Well-graded gravels, gravel-sand mixtures, little or no fines	*GW*	—	—	1	1	—	—	1	1	1	3
Poorly graded gravels, gravel-sand mixtures, little or no fines	*GP*	—	—	2	2	—	—	3	2	3	—
Silty gravels, poorly graded gravel-sand-silt mixtures	*GM*	2	4	—	4	4	1	4	4	9	5
Clayey gravels, poorly graded gravel-sand-clay mixtures	*GC*	1	1	—	3	1	2	6	5	5	1
Well-graded sands, gravelly sands, little or no fines	*SW*	—	—	3 if gravelly 4	6 if gravelly 7	—	—	2	2	2	4
Poorly graded sands, gravelly sands, little or no fines	*SP*	—	—	if gravelly	if gravelly 8	— 5	—	5	6	4	—
Silty sands, poorly graded sand-silt mixtures	*SM*	4	5	—	if gravelly	erosion critical	2	7	8	10	6
Clayey sands, poorly graded sand-clay mixtures	*SC*	3	2	—	5	2 6	4	8	7	6	2
Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	*ML*	6	6	—	—	erosion critical	6	9	10	11	—
Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	*CL*	5	3	—	9	3 7	5	10	9	7	7
Organic silts and organic silt-clays of low plasticity	*OL*	8	8	—	—	erosion critical	7	11	11	12	—
Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	*MH*	9	9	—	—	— 8	8	12	12	13	—
Inorganic clays of high plasticity, fat clays	*CH*	7	7	—	10	volume change critical	9	13	13	8	—
Organic clays of medium to high plasticity	*OH*	10	10	—	—	—	10	14	14	14	—
Peat and other highly organic soils	*Pt*	—	—	—	—	—	—	—	—	—	—

For a landside berm a GW or GP soil would work best, if available. If such a soil is not readily available, an SP or SW soil could be used (if gravelly) for the lower layer of the blanket with a coarse gravel or rock blanket on top. Depending upon the site, adequate material may not be available. If materials for emergency repair of the dam are not readily available at the site, it may be desirable to haul the materials in advance and stockpile them in a safe location with proper protection.

1. Reference (15) - Soil Mechanics, Lambe T. W. and R. V. Whitman



GRANULAR BLANKET

APPROXIMATE CONSTRUCTION REQUIREMENTS

Blanket Area ($ft.^2$)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
Material Req'd. Per Layer ($yd.^3$)	40	80	120	150	190	225	270	300	330	370
No. Trucks & Drivers	3	3	6	6	6	8	10	10	12	12
No. Graders & Operators	5	5	10	10	15	15	15	20	20	20
Total Time Req'd. (Hrs.)	4	8	6	8	8	8	8	8	9	10

EMERGENCY FLOOD FIGHTING

GRANULAR BLANKET

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE B-10

EMERGENCY NOTIFICATION SUBPLAN

APPENDIX C

TO

EMERGENCY PLAN

FOR

SANDY LAKE DAM AND RESERVOIR

JUNE 1987

TABLE OF CONTENTS

LIST OF TABLES

EMERGENCY NOTIFICATION SUBPLAN

SANDY LAKE DAM AND RESERVOIR

C-1. Introduction

Conditions affecting operation of Sandy Lake Dam and Reservoir could result in a hazard to life and/or property due to high reservoir levels or sudden release of large volumes of water. Prompt issuance of appropriate notifications is essential for minimizing hazards to life and property.

a. Purpose

This subplan implements a portion of the Corps program to prepare emergency plans for all Corps dams. It establishes procedures for issuing notifications of impending and existing emergencies affecting the operation and safety of Sandy Lake Dam and Reservoir.

b. Scope

This subplan specifies notifications and other actions to be taken upon declaration of a pre-emergency or emergency condition. Notifications and actions specified are those necessary for:

(1) Ensuring safety.

(2) Vacating project areas where emergency operations and repairs may be conducted.

(3) Internal coordination of Corps of Engineers activities.

(4) Coordination with non-federal units of government and other Federal agencies.

c. Applicability

This subplan is applicable to all Corps elements and field offices concerned with operation of Sandy Lake Dam and Reservoir.

C-2. Definitions

a. Pre-emergency

A "pre-emergency" condition is one in which some impending or existing threat to the safe operation of the dam or reservoir is identified but no significant hazard to life or property is expected to occur.

b. Emergency

An "emergency" condition is one in which the occurrence of a significant hazard to life and/or property is possible or certain to occur. Conditions justifying declaration of an emergency condition may be imminent or longer term.

c. Park Manager

The term "Park Manager" means the individual in charge at the Sandy Lake Dam project site.

d. Mississippi Headwaters Project Office

The term "Mississippi Headwaters Project Office" means the person in charge of the Mississippi Headwaters Project Office.

e. District

The term "District" identifies one of the following elements depending upon which is appropriate for the situation at hand.

(1) Dam Safety Officer. The Dam Safety Officer must be kept informed of all pre-emergency or emergency situations. Responsible for identifying and/or providing the necessary engineering or technical support required for the pre-emergency or emergency situation. Also responsible for keeping the Dam Safety Committee, and the NCD Dam Safety Officer informed of the pre-emergency or emergency situation.

(2) Project Operations Branch. Responsible for identifying a person-in-charge of the pre-emergency or emergency situation. Responsible for keeping the Dam Safety Officer informed of the pre-emergency or emergency situation. Also responsible for matters involving normal dam operations and/or other matters not covered by the other District elements.

(3) Emergency Operations Center. Provides a 24-hour telephone contact with the District Office. Responsible for keeping the Dam Safety Officer, the Commander/District Engineer, and NCD in contact with the operations and personnel. Also responsible for matters involving national security, disasters, and mobilization.

(4) Water Control Center. Part of Hydrology Section in Geotechnical, Hydraulics and Hydrologic Engineering Branch. Responsible for matters involving reservoir regulation.

(5) Geotechnical Design Section. A section in Geotechnical, Hydraulics and Hydrologic Engineering Branch. Responsible for matters involving the structural integrity of the dam.

(6) Design Branch. Responsible for matters involving the structural integrity of the outlet structures.

(7) Project Management Branch. Responsible for management support.

(8) Planning Division. Responsible for management support, and matters involving environmental analysis and cultural resources.

C-3. Basis of Activation

This subplan is to be activated immediately upon declaration of a pre-emergency or emergency condition.

C-4. Parties to be Notified

a. Corps Offices

Corps offices to be notified of all pre-emergency or emergency conditions that are declared are listed in Table C-1.

b. Other Parties

Other parties to be notified according to the nature of an emergency or pre-emergency condition are listed in Table C-2.

c. For High Pool Levels

Additional parties to be notified in the event of anticipated high water levels are listed in Table C-3.

C-5. Responsibility for Notifications

Notifications listed in Tables C-1 and C-2 are the responsibility of the office (Park Manager, Mississippi Headwaters Project Office or District) making the declaration of a pre-emergency or emergency condition. Assistance in making notifications may be requested from other Corps offices and/or other parties. In the event all communications between offices are disrupted after declaration of a pre-emergency or emergency condition, each office will assume responsibility for making all notifications.

C-6. Communications

a. Corps Offices

(1) Normal

Communications between the District and Park Manager, are normally by radio. Radios at the project administration office and District's Emergency Operations Center will be manned on a 24-hour basis during all flood emergencies and whenever a pre-emergency or emergency condition is in effect. (Office and home phone numbers of key Corps personnel are listed in Table C-1).

(2) Back-up

The telephone communications network between the District Office, project administration office and Mississippi Headwaters Project Office will be used to back-up radio communications. Telephones at each office will be manned as required during all flood emergencies and whenever a pre-emergency or emergency condition is in effect and radio service is disrupted. Information on radio frequencies and call letters for key contacts are listed in Table A-1.

(3) Emergency

During a situation when both radio and telephone communications between the District Office and project area are lost, others equipped with radio or telephone facilities will be called on for assistance. Those to whom application for assistance may be made are identified in Table C-1 along with telephone information.

b. Other Parties

(1) Normal

Communications with other parties will normally be by telephone. Office and home phone numbers of key contacts are listed in Table C-2.

(2) Back-up

Communications with other parties will be by radio in the event telephone service is disrupted. The table also lists those parties which can be requested to forward notifications to offices lacking radio equipment.

c. High Pool Levels

Additional parties to be notified in the event of anticipated high

pool levels are listed in Table C-3.

C-7. Timing of Notifications

Parties listed in Table C-1 are to be notified as soon as possible after declaration of a pre-emergency or emergency condition. Notifications listed in Tables C-2 and C-3 are dependent on reservoir water elevation and other conditions and should be made as soon as a high probability of the eventual need for notification is predicted.

C-8. Content of Notification Messages

a. Corps Offices

Notifications are to include the key information needed as a basis for decision making and/or action including, as appropriate and to the extent possible, the following:

(1) Description of Situation

(a) Nature and severity of problem(s).

(b) Current and predicted reservoir conditions including water elevation, inflow and discharge.

(c) Current and forecasted weather conditions.

(2) Action Planned or Underway

(a) Type of corrective actions.

(b) Estimated time to complete corrective actions.

(c) Outlook for success.

(d) Assistance required/being furnished.

(e) Potential complications.

(f) Recommended evacuation.

(3) Other

(a) Staff at dam site.

(b) Visitors at project.

(c) Road conditions.

b. Other Parties

Notification messages are to include a description of the nature of impending or existing hazard, potential timing of its occurrence, and recommendations for evacuation and other action (needed evacuation on project lands managed by the Corps will be directed rather than recommended).

C-9. Pre-emergency Actions

a. Park Manager

For a Park Manager declared or suspect pre-emergency situation, the Park Manager must notify the Mississippi Headwaters Project Office in accord with paragraph C-5, Table C-1 and Figure C-1.

If contact with the Mississippi Headwaters Project Office cannot be made, contact the Dam Safety Officer, Project Operations Branch, and Emergency Operations Center as shown in Table C-1 and Figure C-1

b. Mississippi Headwaters Project Office

Evaluate the situation and declare a pre-emergency condition if warranted.

Notify Dam Safety Officer, Project Operations Branch, and Emergency Operations Center in accord with paragraph C-5, Table C-1 and Figure C-1.

Provide assistance as needed to Park Manager and District Office.

c. District

(1) Dam Safety Officer

(a) The Dam Safety Officer is to be kept informed of all conditions of the pre-emergency situation.

(b) Responsible for identifying and/or providing the necessary engineering or technical support required to resolve the pre-emergency situation.

(c) Evaluate the situation and declare a pre-emergency condition if warranted.

(d) Notify the North Central Division Dam Safety Officer in accord with paragraph C-5 if pre-emergency condition was declared by the Park Manager, Mississippi Headwaters Project Office, or District Office.

(e) Notify the Dam Safety Committee, the Emergency

Operations Center and the Project Operations Branch of the situation.

(2) Project Operations Branch

(a) Must be kept informed of all pre-emergency situations.

(b) Responsible for identifying a person-in-charge of the pre-emergency situation. Also, responsible for matters involving normal dam operations and/or any other matters not covered by other District elements.

(c) Responsible for contacting the Dam Safety Officer for engineering and technical assistance and keeping him informed of the situation. Also, contact the Emergency Operations Center and keep them informed of the situation.

(d) Evaluate the situation and declare a pre-emergency condition if warranted.

(e) Provide needed assistance and/or instructions to the Mississippi Headwaters Project Office, Park Manager and person-in-charge of the pre-emergency situation.

(3) Emergency Operations Center

(a) Twenty-four (24) hour telephone service.

(b) Must be kept informed of all pre-emergency situations.

(c) Responsible for contacting Dam Safety Officer, Project Operations Branch, District Engineer, Public Affairs, and the NCD Emergency Manager.

(d) Responsible for matters involving National Security, Disasters, and Mobilization. Provide emergency response in accordance with ER 500-1-1, National Disaster Procedures.

(e) Evaluate the situation and declare a pre-emergency condition if warranted.

(4) Others

The district personnel listed under this category in Table C-1 are only to be contacted if none of the above District Elements could be reached.

(a) Evaluate the pre-emergency conditions and declare a pre-emergency condition if warranted. Notify the Dam Safety Officer, the Emergency Operations Center and the Project Operations Branch as soon as possible.

(b) If the Project Operations Branch cannot be contacted,

appoint a temporary person-in-charge of the pre-emergency situation.

(c) Provide needed assistance and/or instructions to Mississippi Headwaters Project Office, Park Manager and person-in-charge of the pre-emergency situation.

C-10. Emergency Actions

a. Park Manager

(1) For a Park Manager declared emergency or suspect emergency situation, the Park Manager must notify the Mississippi Headwaters Project Office in accord with paragraph C-5, Table C-1 and Figure C-1.

If contact with the Mississippi Headwaters Project Office cannot be made, contact the Dam Safety Officer, Project Operations Branch, and Emergency Operations Center as shown in Table C-1 and Figure C-1.

(2) Cancel normal work schedule and provide for 24-hour duty as needed.

(3) Assess project areas which are or may become unsafe including but not limited to:

(a) Reservoir water surface.

(b) Day use and recreational areas within project boundaries including those managed by others.

(4) Identify areas required for conduct of emergency operations and repairs including any necessary access routes.

(5) Take action to notify and evacuate areas which are unsafe, potentially unsafe, or where emergency operations and repair work may be carried out including, as appropriate:

(a) Directing evacuation of affected project areas managed by the Corps.

(b) Closing project roads to incoming traffic.

(c) Moving equipment to safe areas.

(6) Request assistance as needed in carrying out items (5)(a) and (5)(b) from agencies listed in Table C-2.

(7) Assume District responsibilities for notifications if emergency condition was declared by Park Manager.

(8) Verify appropriate warnings if announced over local radio and television.

b. Mississippi Headwaters Project Office

Evaluate the situation and declare an emergency condition if warranted.

Notify the Dam Safety Officer, Project Operations Branch, and Emergency Operations Center in accord with paragraph C-5, Table C-1 and Figure C-1.

Provide assistance to Park Manager or District as required to accomplish the following tasks:

(1) Cancel normal work schedule and provide for key staff as needed.

(2) Assess project areas which are or may become unsafe including but not limited to:

(a) Reservoir water surface.

(b) Day use and recreational areas within project boundaries including those managed by others.

(3) Identify areas required for conduct of emergency operations and repairs including any necessary access routes.

(4) Take action to notify and evacuate areas which are unsafe, potentially unsafe, or where emergency operations and repair work may be carried out including, as appropriate:

(a) Directing evacuation of affected project areas managed by the Corps.

(b) Closing project roads to incoming traffic.

(c) Moving equipment to safe areas.

(5) Request assistance as needed in carrying out items (4)(a) and (4)(b) from agencies listed in Table C-2.

(6) Assume District responsibilities for notifications if emergency condition was declared by Park Manager.

(7) Verify that appropriate warnings are announced over local radio and television.

c. District

(1) Dam Safety Officer

The Dam Safety Officer is to be kept informed of all conditions of the emergency situation.

(a) Responsible for identifying and/or providing the necessary engineering or technical support required to resolve the emergency situation.

(b) Evaluate the situation and declare an emergency condition if warranted.

(c) Notify the North Central Division Dam Safety Officer in accord with paragraph C-5 if an emergency condition was declared by the Park Manager, Mississippi Headwaters Project Office, or District Office.

(d) Notify the Dam Safety Committee, the Emergency Operations Center and the Project Operations Branch of the situation.

(2) Project Operations Branch

(a) Must be kept informed of all emergency situations.

(b) Responsible for identifying a person-in-charge of the emergency situation. Also, responsible for matters involving normal dam operations and/or any other matters not covered by other District elements.

(c) Responsible for contacting the Dam Safety Officer for engineering and technical assistance and keeping him informed of the situation. Also, contact the Emergency Operations Center and keep them informed of the situation.

(d) Evaluate the situation and declare an emergency condition if warranted.

(e) Provide needed assistance and/or instructions to the Mississippi Headwaters Project Office, Park Manager and person-in-charge of the emergency situation.

(f) Cancel normal work schedule and provide for key staff as needed.

(g) Determine which of the two planning conditions (PMF without failure or PMF with failure) best represents potential inundation and needs for evacuation.

(h) Determine need for warning of high reservoir levels.

(i) Formulate and issue warning message(s) to affected non-federal parties in accord with paragraph C-6.

(j) Verify appropriate warnings as released over local radio and television.

(3) Others

The District personnel listed under this category in Table C-1 are only to be contacted if none of the above District personnel could be reached.

(a) Evaluate the emergency conditions and declare an emergency condition if warranted. Notify the Dam Safety Officer, the Emergency Operations Center and the Project Operations Branch as soon as possible.

(b) If the Project Operations Branch cannot be contacted, appoint a temporary person-in-charge of the emergency situation.

(c) Provide needed assistance and/or instructions to Mississippi Headwaters Project Office, Park Manager and person-in-charge of the emergency situation.

d. North Central Division

Notify the Office of the Chief of Engineers and other Federal agencies as appropriate.

e. Office of the Chief of Engineers

Notify other Federal agencies as appropriate, such as the Federal Emergency Management Agency.

C-11. Example Messages

Preparation of warning messages should begin as soon as their potential need is apparent so that they can be issued promptly upon declaration of an emergency condition. When time is available, all public notices should be released by the Public Affairs Office or contact Emergency Management or the Hastings Electronic Service Center, if the P.A.O. cannot be reached (Table C-1). In some cases, an emergency condition may be declared with little or no advance notice. The following example messages provide a model for the first announcements in such cases. The Public Affairs Office would then be contacted as soon as time permits. They would release subsequent announcements to provide additional details.

a. **Announcement for Slowly Developing Conditions**

THE ARMY CORPS OF ENGINEERS AT ST. PAUL ANNOUNCED AT (time) TODAY THAT AN EMERGENCY CONDITION EXISTS AT (name of dam) DAM DUE TO (general description of problem). THE DAM IS LOCATED ON (stream) ABOUT (distance) MILES UPSTREAM OF (name of downstream community and state).

A CORPS SPOKESMAN SAID THAT THE WATER LEVEL OF (name of reservoir) WAS BEING LOWERED (as a precautionary measure/to reduce pressure on the dam/to enable repair work). THE SPOKESMAN EMPHASIZED THAT THE DRAWDOWN OF THE POOL WAS BEING CARRIED OUT UNDER CONTROLLED CONDITIONS AND THERE IS NO IMMEDIATE DANGER OF THE DAM FAILING. HOWEVER, THE LARGE RELEASES OF WATER THAT ARE BEING MADE MAY CAUSE FLOODING ALONG (stream). SHOULD (evacuate/be alert for high water and prepare to evacuate).

ADDITIONAL INFORMATION WILL BE RELEASED AS PROMPTLY AS POSSIBLE.

b. **Announcement for Rapidly Developing Conditions**

URGENT: THE ARMY CORPS OF ENGINEERS HAS ANNOUNCED THAT (name of dam) DAM IS IN IMMINENT DANGER OF FAILURE. THE DAM IS LOCATED ABOUT (distance) MILES UPSTREAM OF (name of downstream community and state).

ATTEMPTS TO SAVE THE DAM ARE UNDERWAY BUT THEIR SUCCESS CANNOT BE DETERMINED YET. RESIDENTS ALONG THE (stream) SHOULD EVACUATE TO HIGH GROUND IMMEDIATELY. RESIDENTS ALONG THE (stream) IN THE VICINITY OF (city) AND DOWNSTREAM SHOULD REMAIN ALERT FOR FURTHER INFORMATION.

IF THE DAM FAILS, WATER WILL TAKE APPROXIMATELY (time) HOURS TO REACH THE LOWER END OF (city, stream, etc.). AREAS CLOSER TO DAM WILL BE FLOODED SOONER.

ADDITIONAL INFORMATION WILL BE RELEASED AS PROMPTLY AS POSSIBLE.

c. **Announcement for High Reservoir Levels**

THE ARMY CORPS OF ENGINEERS AT ST. PAUL ANNOUNCED AT (time) TODAY THAT AN EMERGENCY CONDITION EXISTS AROUND (name of reservoir) DUE TO EXPECTED HIGH WATER LEVELS. THE LAKE IS LOCATED ON (stream) ABOUT (distance) MILES UPSTREAM OF (community and state).

THE CORPS SPOKESMAN SAID THAT THE WATER LEVEL IN THE LAKE WAS EXPECTED TO REACH ELEVATION (elev) AT (time) DUE TO (general description of problem). THIS WATER LEVEL WILL (describe major effects).

LARGE RELEASES OF WATER ARE BEING MADE FROM THE DAM IN AN ATTEMPT TO CONTROL THE LAKE LEVEL. RESIDENTS OF LOW LYING AREAS ALONG (stream) SHOULD BE ALERT TO POSSIBLE FLOODING AND PREPARE TO EVACUATE.

FURTHER INFORMATION WILL BE RELEASED AS PROMPTLY AS POSSIBLE.

TABLE C-1
NOTIFICATION LIST
FOR CORPS OF ENGINEERS
OFFICES (INTERNAL)

OBSERVER

1. Observer potential dam problem.
2. Gather pertinent facts to describe situation.
3. Assess whether slowly developing, rapidly developing or imminent failure.
4. Notify first available lockmaster in order shown.

(If contact cannot be made with Lockmasters listed below, contact the Dam Safety Officer, Project Operations Branch, or Emergency Operations Center as shown on the attached list.)

DAM SUPERVISOR

	Office	Home Phone	Radio
*Donald Daly	(218)426-3482	(218)426-3482	SSB/FM WUD632
Terry Ladd	(218)426-3482	(218)845-2921	SSB/FM WUD632

1. Assess observer's report.
2. Take necessary emergency actions.
3. Notify Area Lockmaster, Dam Safety Officer, Project Operations Branch, or Emergency Operations Center.

AREA PROJECT OFFICE

	Office	Home Phone	Radio
James Ruyak	(218)566-2306	(218)566-1294	SSB/FM WUD639

1. Assess the situtation.
2. Take necessary emergency actions.
3. Notify Dam Safety Officer, Project Operations Branch, or Emergency Operations Center.

SHEET 1 of 4

2 of 4 3 of 4 4 of 4
(REFER TO SHEETS)

TABLE C-1
NOTIFICATION LIST
FOR CORPS OF ENGINEERS
OFFICES (INTERNAL)

PROJECT OPERATIONS BRANCH

	Office	Home Phone
Dennis Cin	(612)220-0320	(612)455-6786
Thomas Oksness	(612)220-0322	(612)439-0272
Dennis Erickson	(612)220-0325	(612)452-6850

Responsible for identifying a person-in-charge of the pre-emergency or emergency situation. Must be kept informed of all pre-emergency or emergency situations. Also contact for matters involving normal dam operations, and/or matters not covered by other District elements. Project Operations Branch will contact Dam Safety Officer for engineering and technical assistance and keep him informed of situation.

OTHER DISTRICT PERSONNEL

Office	Office	Home Phone	Radio	
Western Flood Control Office				
Timothy Bertschi	(701)232-1894	(701)232-5967	FM	WUD 642
Headwaters Project Office				
James Ruyak	(218)566-2306	(218)566-1294	FM	WUD 639
Mississippi River Project Office				
Richard Otto	(507)895-6341	(507)895-6224	FM	WUD 645
Park Managers				
Eau Galle/ Mathiesen	(715)778-5562	(715)778-4597	FM/SSB	WUD 643
Homme/Odegaard	(701)845-2970	(701)845-2982	FM/SSB	WUD 636
Baldhill/ Odegaard	(701)845-2970	(701)845-2982	FM/SSB	WUD 636
Lk.Traverse/ Salberg	(612)563-4586	(612)563-4586	FM/SSB	WUD 638
Orwell/ Salberg	(612)563-4586	(612)563-4586	FM/SSB	WUD 638
Lac Qui Parle/ Hanson	(612)269-6303	(612)269-9632	FM/SSB	WUD 630
Sandy/ Daly	(218)426-3482	(218)426-3482	FM/SSB	WUD 632
Pokegama/Vacant	(218)326-6128	Not Appliable	FM/SSB	WUD 633
Leech Lake/ Zahalka	(218)654-3145	(218)566-1642	FM/SSB	WUD 634
Pine River/Hermerding	(218)692-4488	(218)692-2118	FM/SSB	WUD 640
Winnibigoshish/Vacant	(218)246-8107	Not Appliable	FM/SSB	WUD 631
Gull Lake/ Espenson	(218)829-3334	(218)778-4255	FM/SSB	WUD 635

TABLE C-1
NOTIFICATION LIST
FOR CORPS OF ENGINEERS
OFFICES (INTERNAL)

DAM SAFETY OFFICER*

	Office	Home Phone
Robert Post	(612)220-0303	(612)437-1316
William Goetz	(612)220-0310	(612)454-3722
Stan Kumpula	(612)220-0304	(612)484-8957

To be informed of all pre-emergency or emergency situations. responsible for identifying and/or providing the necessary engineering or technical support required to resolve the pre-emergency or emergency situation.

DAM SAFETY COMMITTEE

	Office	Home Phone
William Goetz	(612)220-0310	(612)454-3722
Helmer Johnson	(612)220-0602	(612)633-7791
Robert Engelstad	(612)220-0610	(612)459-6343
Robert Fletcher	(612)220-0510	(612)484-4998
Dennis Cin	(612)220-0320	(612)455-6786
Dale Mazar	(612)220-0444	(612)631-1940
Stan Kumpula	(612)220-0304	(612)484-8957

NCD DAM SAFETY OFFICER*

	Office	Home Phone
Zane Goodwin*	(312)353-6311	(312)823-4606
Carl Cable	(312)353-6372	(312)357-4529
Don Leonard	(312)353-6355	(312)359-3372
Lee Hoglind	(312)353-6358	(312)579-0148

OCE DAM SAFETY OFFICER*

	Office	Home Phone
Lloyd Duscha	(202)272-0332	(703)860-1319
William McCormick	(202)272-0397	(703)569-4323
Jack Thompson	(202)272-0215	(703)978-5627
Edward Prickett	(202)272-0207	(301)865-5876
Robert Smith	(202)272-0220	(703)569-3128
Earl Elker	(202)272-8500	(301)465-2120
John Elmore	(202)272-0196	(703)339-8279
Chief, Hydraulics and Hydrology Division	(202)272-0228	

TABLE C-1
NOTIFICATION LIST
FOR CORPS OF ENGINEERS
OFFICES (INTERNAL)

EMERGENCY OPERATIONS CENTER

	Office	Home Phone
District EOC	(612)220-0208	(24-hr. Number)
David Christenson	(612)220-0204	(612)690-5749

Twenty-four (24) hour telephone service. Must be kept informed of all pre-emergency or emergency situations. Also contact for matters involving national security, disasters, mobilization or NWR flood forecasts. Center will contact Dam Safety Officer, the Commander/District Engineer and NCD.

DISTRICT ENGINEER

	Office	Home Phone
Col. Joseph Briggs	(612)220-0300	(612)894-7142

PUBLIC AFFAIRS OFFICE

	Office	Home Phone
Kennon Gardner	(612)220-0201	(612)884-9023
24-Hr. Answer Machine	(612)220-0200	

NCD EMERGENCY MANAGER

	Office	Home Phone
Natural Disaster Planner Bernard Bochantin	(312)353-5275	(815)568-7544
Chief Emergency Management Tim Monteen	(312)886-8451	(312)961-2195

DISTRICT RADIO

Contact Electronic Service Center at	(612)437-2210	WUD6
SSB Primary		5400Khz
1st Alternate		6020Khz
Emergency		5015KhzLSB

For additional information see Appendix CNCS 500-1-1.

TABLE C-2

KEY CONTACTS FOR EMERGENCY NOTIFICATIONS - EXTERNAL

Cities and Towns	Telephone Office	Residence
Aitkin, MN		
Civil Defense Director	(218) 927-2527	
COUNTIES		
Aitkin County, MN		
Civil Defense Director	(218) 927-2102 Ext. 29	(218) 927-2542
Sheriff (24 hour)	(218) 927-2138	
STATE AGENCIES		
MN Division of Emergency Services	(612) 296-2233	(612) 778-0800
Region II Coordinator	(218) 327-1796	(218) 245-3711
MN Dept. of Natural Resources	(612) 296-2922	
Statewide Emergency Number	1-800-422-0798	
Metro Area	(612) 649-5451	
Backup ONLY	(612) 296-2100	
FEDERAL AGENCIES		
National Weather Service	(612) 725-3401	

TABLE C-3

IDENTIFICATION OF EMERGENCY CONDITIONS AND REQUIRED INTERNAL AND EXTERNAL NOTIFICATIONS

ELEVATION*	PROBLEM	PARTIES TO BE NOTIFIED	ACTION
1. HIGH RESERVOIR LEVEL			
1216.31	Normal pool	Mississippi Headwaters Project Office (MHPO) District	
1216.56	Top summer band		
1218.31	Full pool	MHPO District North Central Division (NCD) National Weather Service (NWS)	Apprise them of situation (for info. only).
2. EMERGENCY DRAWDOWN			
	Possible Failure of Sandy Lake Dam (Failure not imminent)	MHPO District NCD NWS MN-DES County Civil Defense Coordinators (CCDC)	Apprise them of the situation and that we are increasing discharges.
3. IMMINENT DAM FAILURE			
1221.31	Overtopping of embankment (Failure by overtopping will not come without prior warning in the form of heavy runoff, large inflow and rapidly rising pool levels)	MHPO District NCD Aitkin, MN MN-DES CDCC'S NWS	Apprise them of the situation. Use caution/ evacuate. (As appropriate).
	Failure of the embankment	MHPO District	Apprise them of the situation.

*Elevation refers to MSL 1929 adj.

NOTIFICATION FOR DAM PROBLEMS

US Army Corps of Engineers
St Paul District

PROJECT SANDY LAKE DAM

US Army Corps of Engineers
St Paul District

OBSERVER

1. Observe potential dam problem.
2. Gather pertinent facts to describe situation.
3. Assess whether slowly developing, rapidly developing, or imminent failure.
4. Notify first available Dam Supervisor in order shown.

(If contact cannot be made with supervisors listed below, contact Area Project Office. If contact cannot be made, contact the Dam Safety Officer, Project Operations Branch, or Emergency Operations Center, as shown on attached list.)

Dam Supervisor (218)426-3482 Radio SSB WUD 632

	Home Phone
Donald Daly	(218)426-3482

1. Assess observer's report.
2. Take necessary emergency actions.
3. Notify Area Project Office. (If contact cannot be made, contact Dam Safety Officer, Project Operations Branch, or Emergency Operations center, shown on attached list.)

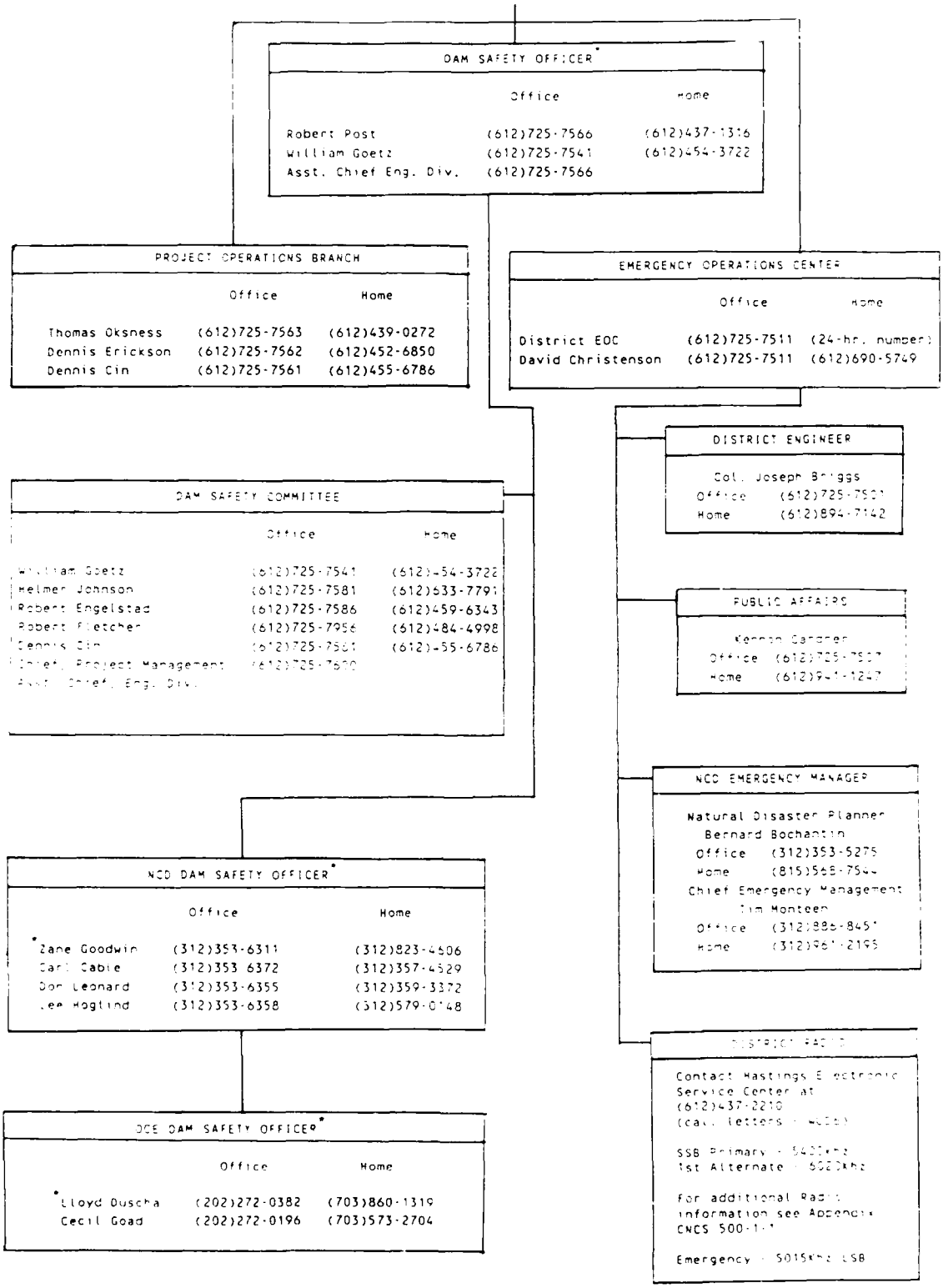
Area Project Office (218)566-2306 Radio SSB WUD 639

	Home Phone
James Ruyak	(218)566-1294

1. Assess the situation
2. Take necessary emergency actions.
3. Notify Dam Safety Officer, Project Operations Branch, or Emergency Operations Center.

FIGURE C-1

FIGURE C-1 CONT.



INUNDATION MAP PACKAGE

APPENDIX D

TO

EMERGENCY PLAN

FOR

SANDY LAKE DAM AND RESERVOIR

JUNE 1987

TABLE OF CONTENTS

LIST OF PLATES

INUNDATION MAPS

SANDY LAKE DAM AND RESERVOIR

D-1. Introduction

This appendix presents the Inundation Maps and other hydraulic data for the area downstream of the Sandy Lake Dam for the following emergency situations: Probable Maximum Flood (PMF) without and with dam failure, failure at normal high pool level, 75% PMF without and with dam failure, 45% PMF without and with dam failure, and threshold flood without and with dam failure.

D-2. Explanation of Maps

The attached maps indicate the area which would be flooded under the hypothesized conditions of: a) occurrence of a Probable Maximum Flood at Sandy Lake Dam; and b) occurrence of a failure of the dam concurrent with a Probable Maximum Flood. The peak flows past Pokegama Dam for these conditions are approximately 20,300 cfs and 20,000 cfs, respectively. The possibility is extremely remote that either of these conditions will occur.

Preparation of the maps does not reflect on the safety or integrity of Sandy Lake Dam. They have been prepared as part of a national program to prepare similar maps for all Federal Dams.

The attached maps provide a basis for evaluating existing evacuation plans for the affected area and development of any further plans which are needed. The Corps of Engineers recommends that such evaluations be made and any needed supplemental plans be developed. Information on evacuation planning and examples of evacuation plans are available from the Corps of Engineers.

D-3. Use of Maps

The general procedure for use of the attached maps is as follows:

a. Determine the portion of your area of concern which would be affected by inundation or isolation.

b. Identify routes which would be used for movement of people from each part of the area to be evacuated.

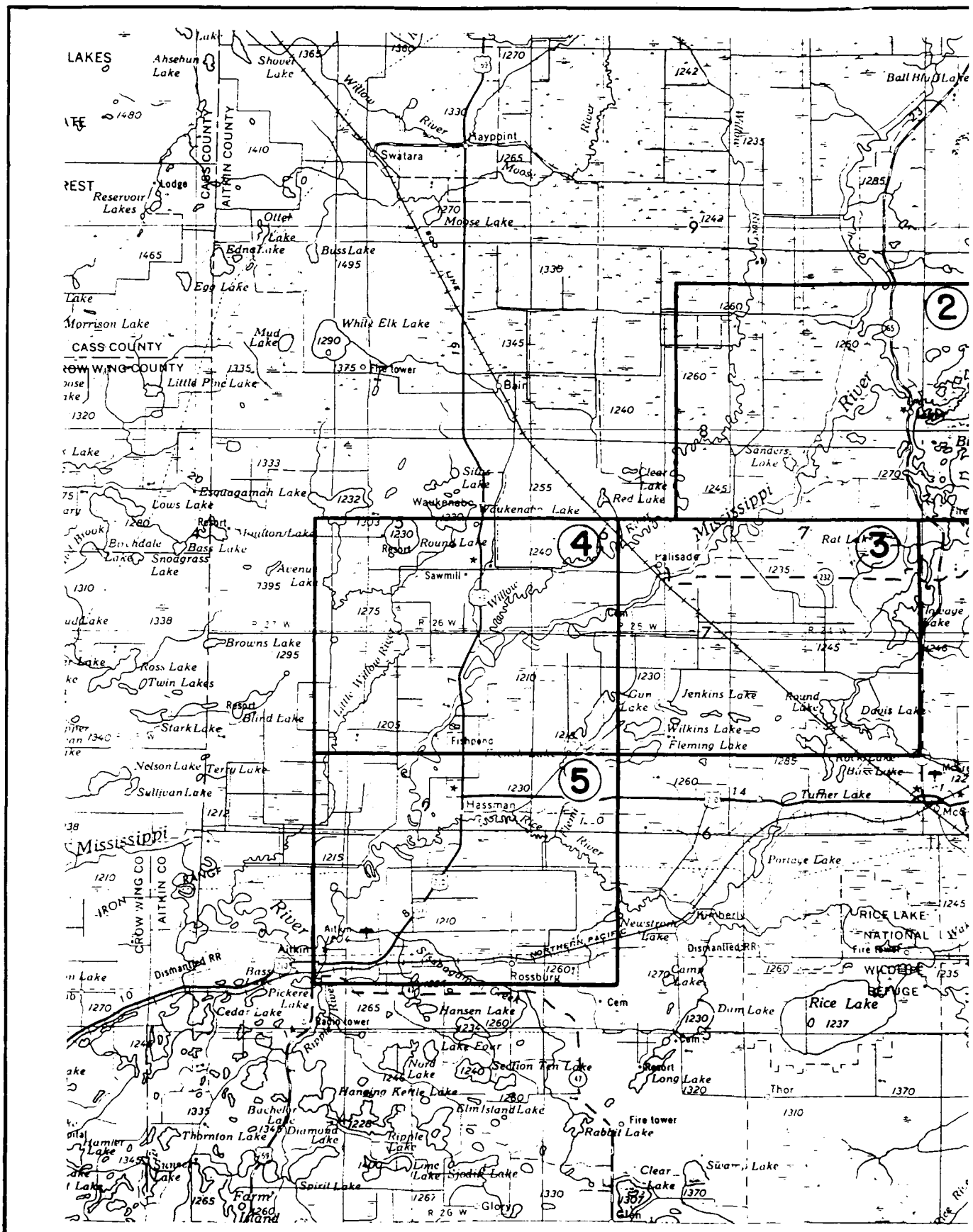
c. Identify the amount of time available for evacuation.

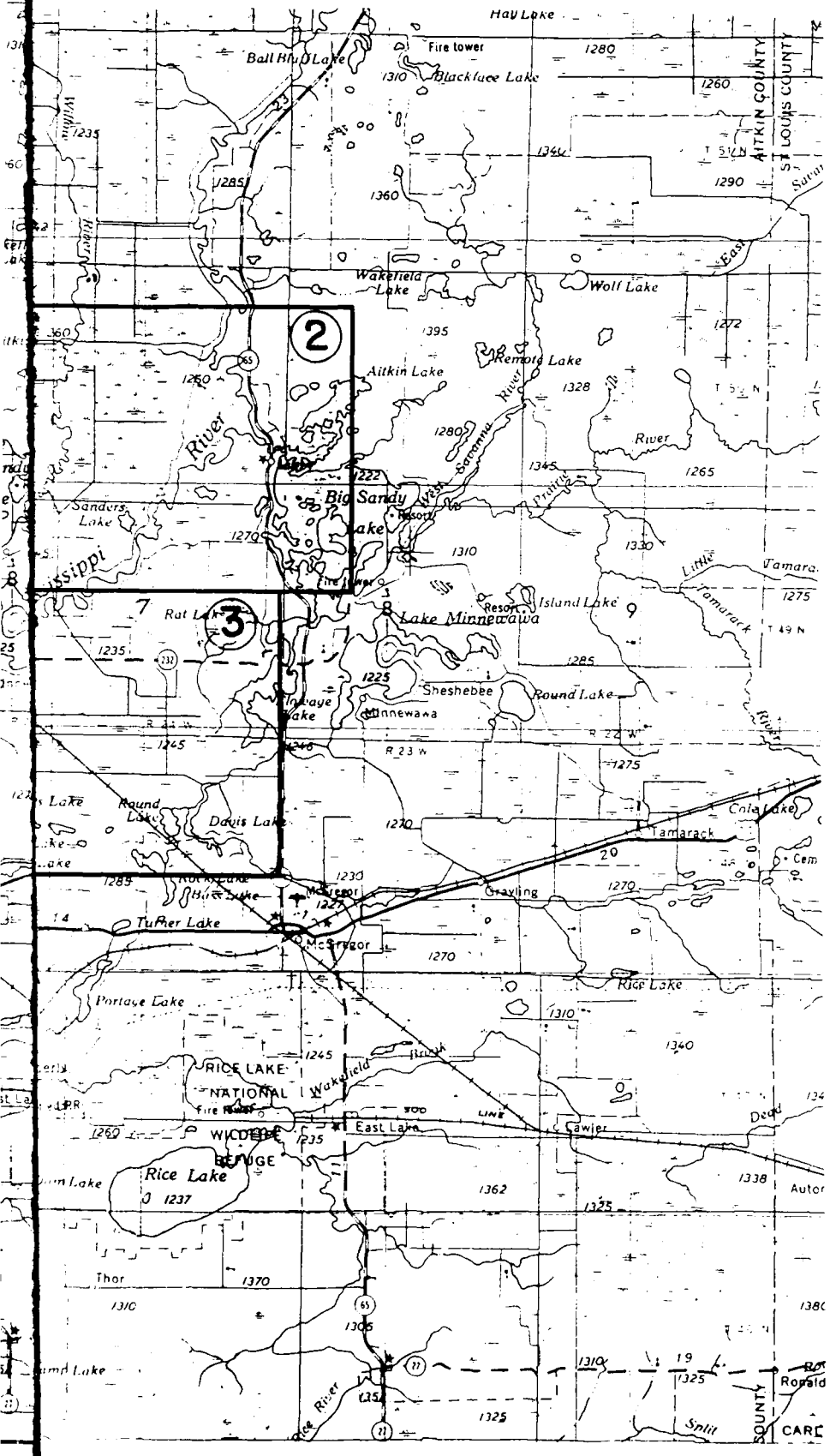
d. Use the information to assess whether existing evacuation plans cover all of the affected area and will provide for timely evacuation.

D-4. Definition of Terms

River mile	The distance along the channel of the Sandy and Mississippi Rivers from Sandy Lake Dam.
Peak elevation	The computed maximum water surface elevation which would be reached at a location due to assumed conditions.
Peak time	Elapsed time* after assumed event until peak elevation occurs.
NGVD	National Geodetic Vertical Datum (distance above mean sea level, 1929 adj.)
Probable Maximum Flood	The theoretical maximum flow that can be expected from the watershed.
Dam failure	Any condition resulting in the uncontrolled release of water other than over or through an uncontrolled spillway or outlet works.
Cross section	Point at which the shape of a stream channel or valley is measured, usually in a direction perpendicular to the direction of flow.
Arrival time	Arrival time of hazardous flows to a point, measured from the beginning of the storm.
Emergency	A condition in which the occurrence of a significant hazard to life or property is possible or certain to occur.

*Elapsed time for the case of Probable Maximum Flood without failure is measured from the time at which the reservoir level exceeds the top of the flood control pool. Elapsed time for the cases of Probable Maximum Flood with failure and failure at normal high pool level are measured from the beginning of failure.


LAKES
Ahsehun Lake
Shovel Lake
Willow River
Hayppint
Swatara
Moose
Moose Lake
Reservoir Lakes
Lodge
CASS COUNTY
AITKIN COUNTY
Ollet Lake
Edna Lake
Buss Lake
Egg Lake
Morrison Lake
Mud Lake
White Elk Lake
Fire tower
Little Pine Lake
CROW WING COUNTY
Esquagamah Lake
Lows Lake
Resort
Houlton Lake
Birchdale
Bass Lake
Snodgrass Lake
Browns Lake
Ross Lake
Twin Lakes
Blind Lake
Stark Lake
Nelson Lake
Terry Lake
Sullivan Lake
Mississippi River
IRON RANGE
CROW WING CO
AITKIN CO
Dismantled RR
Pickerel Lake
Cedar Lake
Ripple River
Hanging Kettle Lake
Bucholtz Lake
Diamond Lake
Thornton Lake
Ripple Lake
Spirit Lake
Farm Island
Glory
Silver Lake
Waukenabo
Waukenabo Lake
Red Lake
Round Lake
Sawmill
Willow River
Little Willow River
Fishpond
Hassman
Rice River
Rossburg
Sandy Lake
Clear Lake
Sanders Lake
Palisade
Rat Lake
Gun Lake
Jenkins Lake
Round Lake
Davis Lake
Wilkins Lake
Fleming Lake
Turtle Lake
Portage Lake
Newstrom Lake
Aitkin
NORTHERN PACIFIC
Hanson Lake
Lake Four
Section Ten Lake
Nord Lake
Elm Island Lake
Rabbit Lake
Long Lake
Thor
Camp Lake
Dam Lake
Rice Lake
RICE LAKE NATIONAL WILDLIFE REFUGE
Fire tower
Lime Lake
Sjodin Lake
Swamp Lake
Clear Lake
Cem
R 26 W
R 25 W
1
2
3
4
5
6
7
8
9
10
14



N

LEGEND

Inundation Map Plate No. ◯

Locations of Map Panels

—— 12 Cross Section

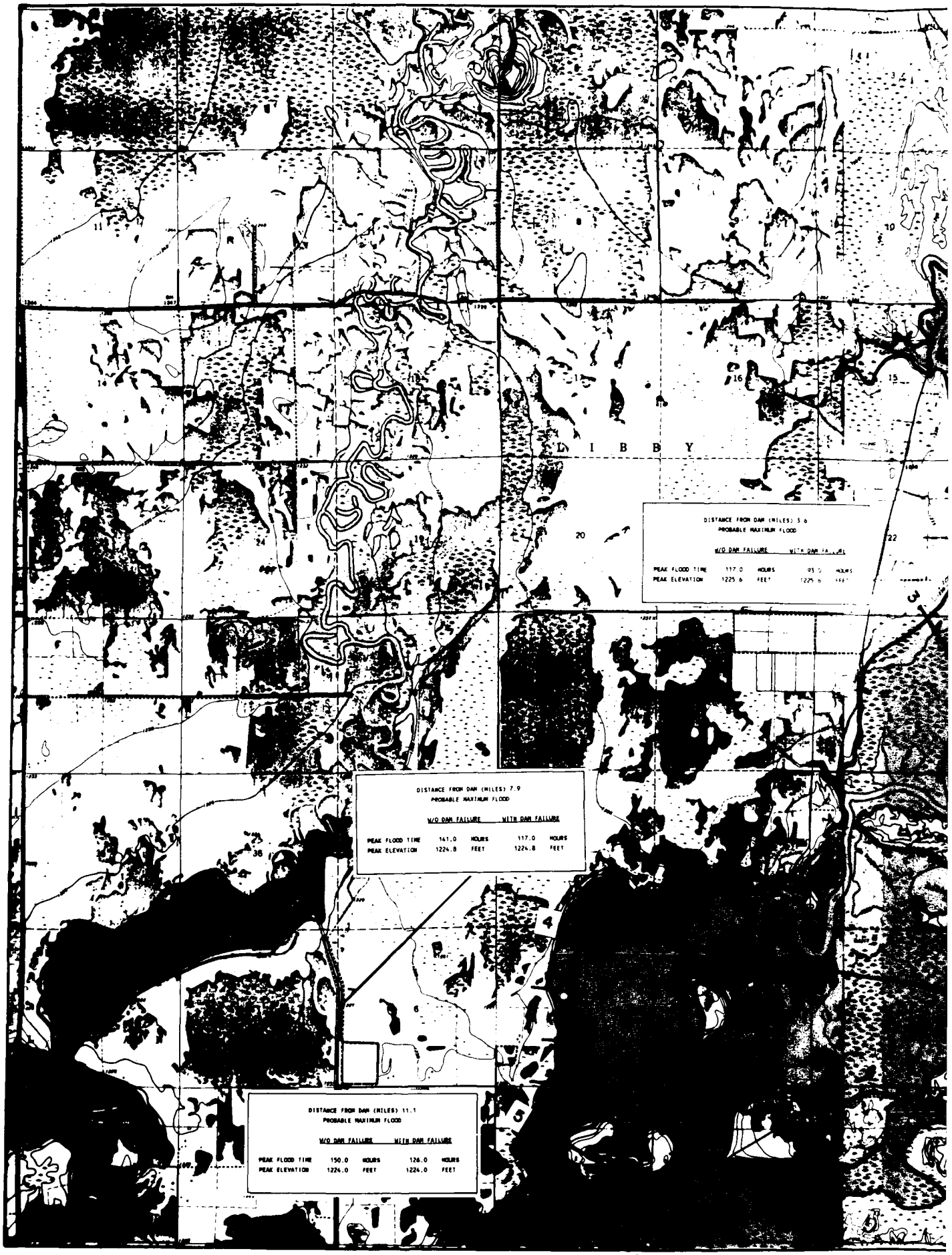
5 0 5

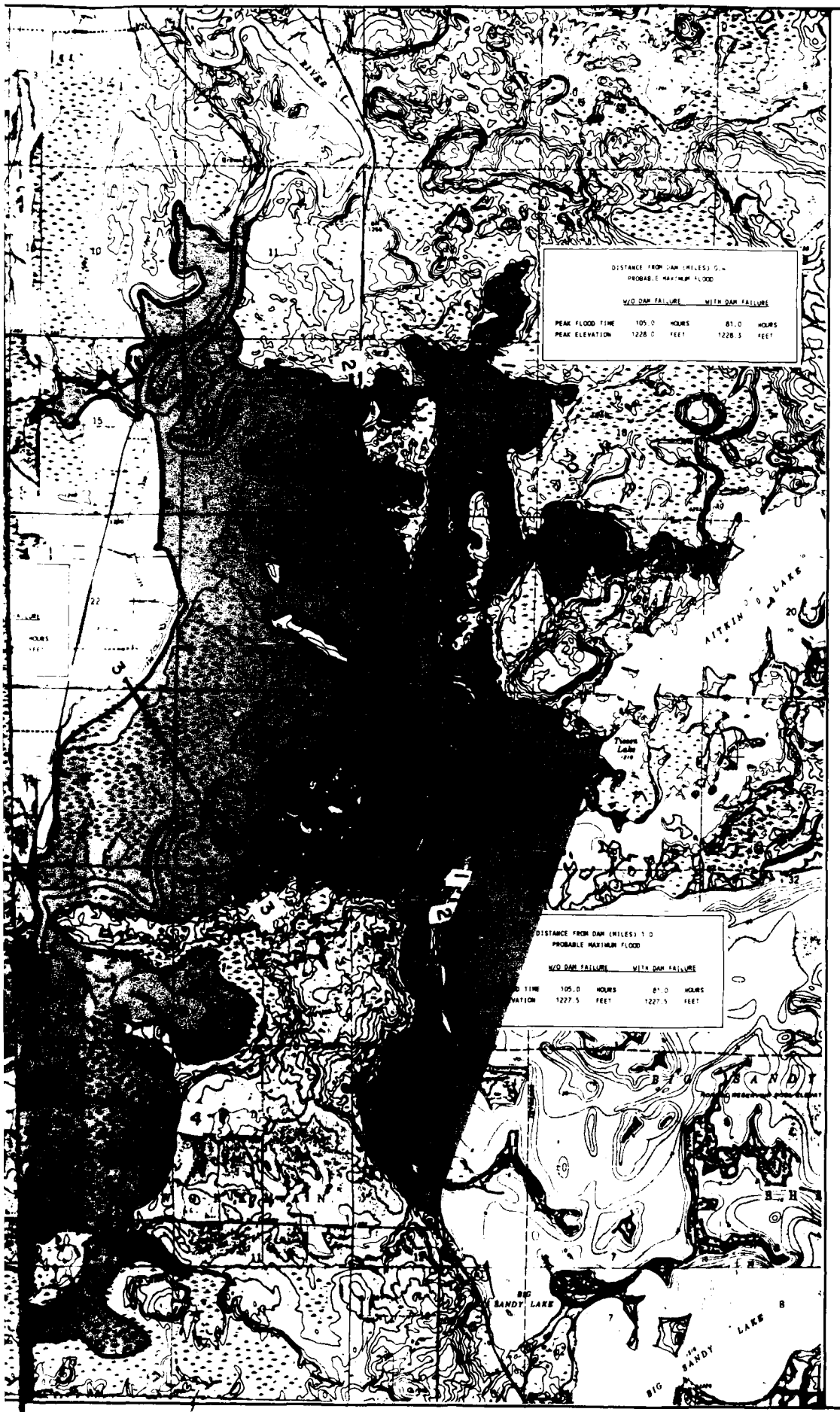
SCALE IN MILES

INDEX MAP

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE D-1


L I B B Y
DISTANCE FROM DAM (MILES) 3.6
PROBABLE MAXIMUM FLOOD
W/O DAM FAILURE
PEAK FLOOD TIME 117.0 HOURS
PEAK ELEVATION 1225.6 FEET
DISTANCE FROM DAM (MILES) 7.9
PROBABLE MAXIMUM FLOOD
W/O DAM FAILURE WITH DAM FAILURE
PEAK FLOOD TIME 141.0 HOURS 117.0 HOURS
PEAK ELEVATION 1224.8 FEET 1224.8 FEET
DISTANCE FROM DAM (MILES) 11.1
PROBABLE MAXIMUM FLOOD
W/O DAM FAILURE WITH DAM FAILURE
PEAK FLOOD TIME 150.0 HOURS 126.0 HOURS
PEAK ELEVATION 1224.0 FEET 1224.0 FEET



N

LEGEND

AREA 16

Area of Potential Secondary Problems Stemming From Inundation: See Table 5.

Limit of Probable Maximum Flood Without Dam Failure

Limit of Probable Maximum Flood With Dam Failure

32 — 32 Cross Section

Corporate Limits

-2000 0 2000 4000 6000

SCALE IN FEET

Contour interval 10 feet

National Geodetic vertical datum of 1929

Source of base map: U. S. Geological Survey, 7.5 minute series, Libby, Minnewawa, Palisade, Sanders Lake, 1970

NOTE: The inundated areas shown on this map reflect events of an extremely remote nature. These results are not in any way intended to reflect upon the integrity of the Sandy Lake Dam

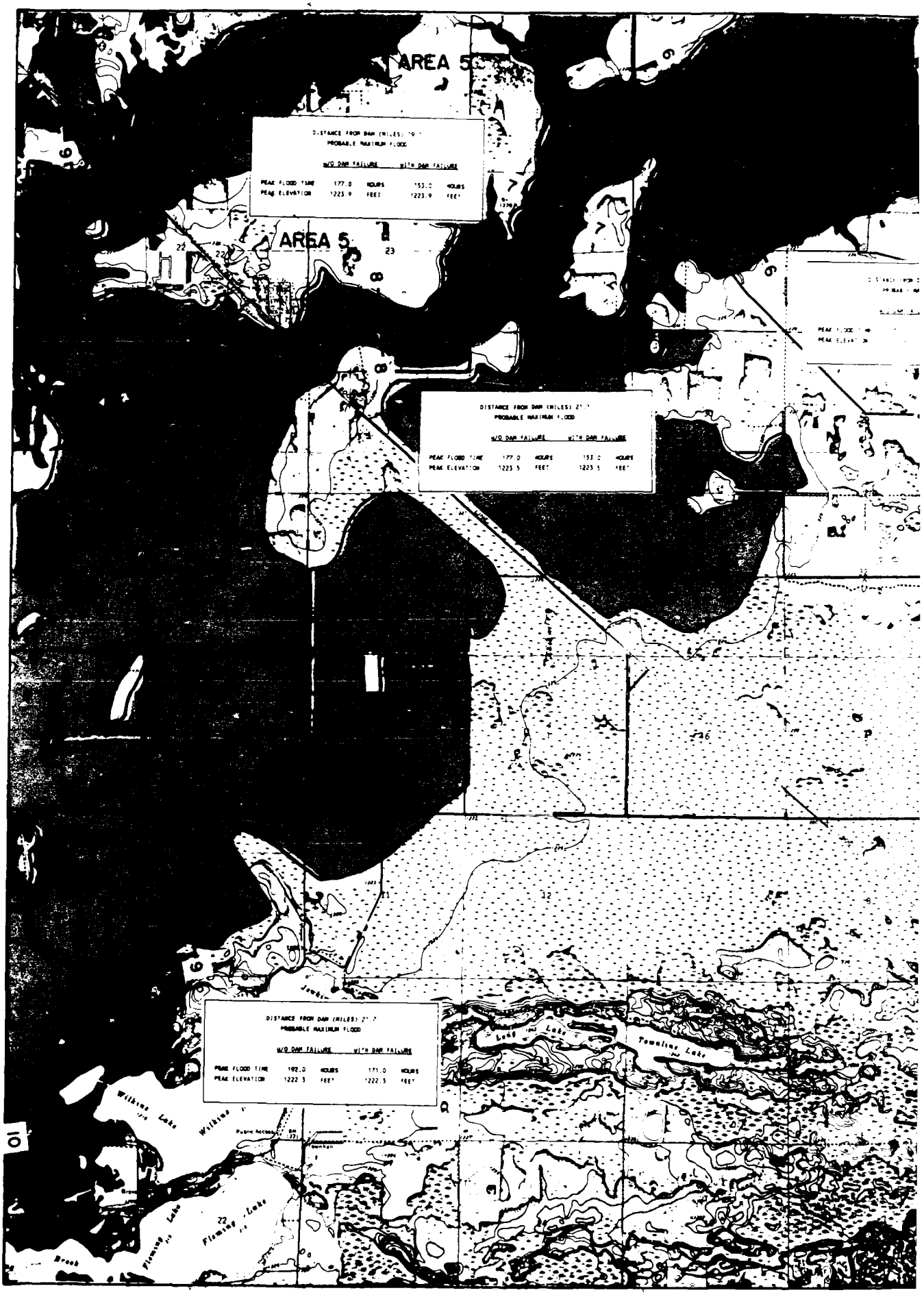
U. S. ARMY ENGINEER DISTRICT, ST. PAUL
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

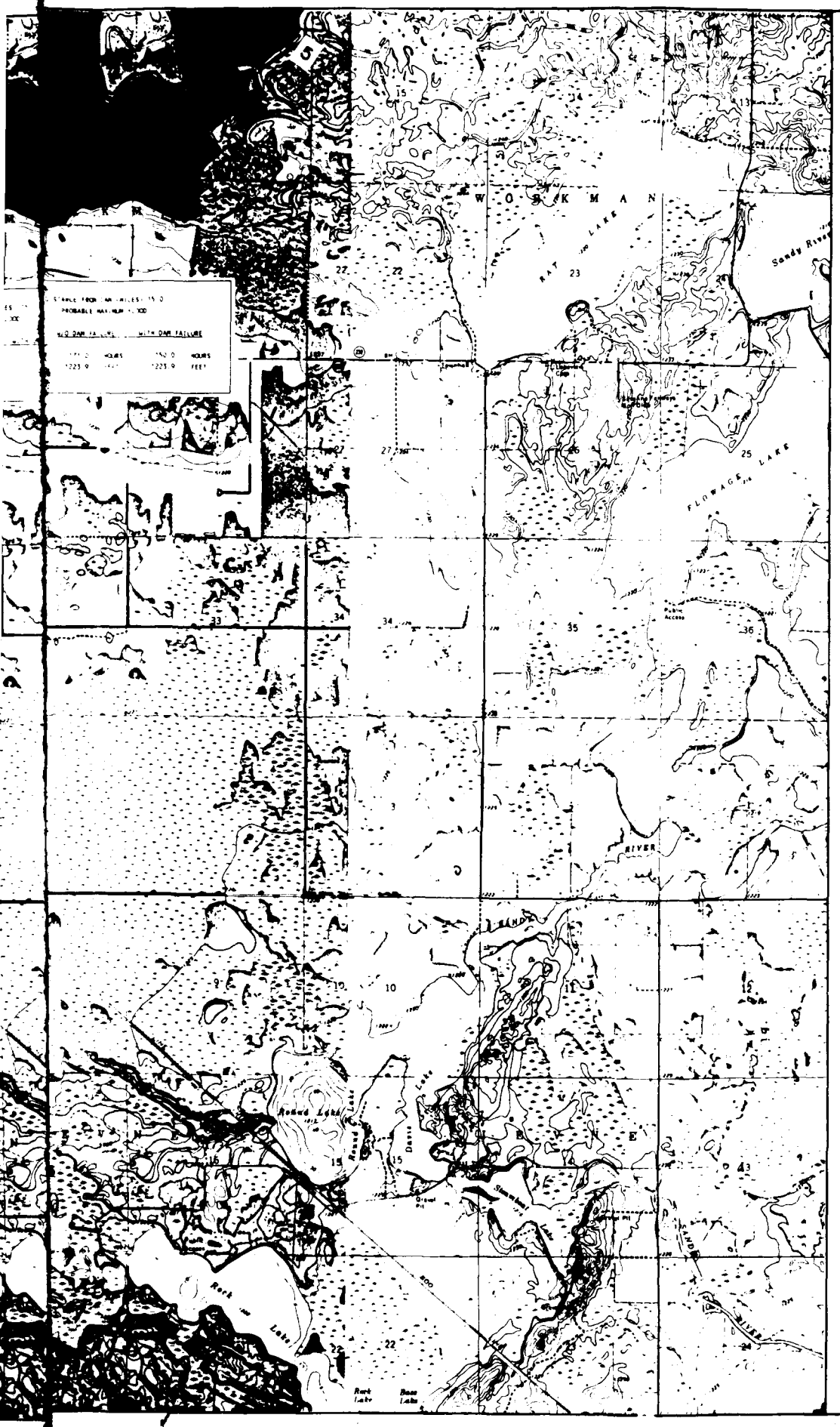
SANDY LAKE DAM
EMERGENCY PLAN

INUNDATION MAP

JULY 1987

PLATE NO. D2


AREA 5
AREA 5
DISTANCE FROM DAM (MILES) 10.1
PROBABLE MAXIMUM FLOOD
W/O DAM FAILURE
WITH DAM FAILURE
PEAK FLOOD TIME 177.0 HOURS 153.0 HOURS
PEAK ELEVATION 1223.9 FEET 1223.9 FEET
DISTANCE FROM DAM (MILES) 21.1
PROBABLE MAXIMUM FLOOD
W/O DAM FAILURE
WITH DAM FAILURE
PEAK FLOOD TIME 177.0 HOURS 153.0 HOURS
PEAK ELEVATION 1223.5 FEET 1223.5 FEET
DISTANCE FROM DAM (MILES) 21.7
PROBABLE MAXIMUM FLOOD
W/O DAM FAILURE
WITH DAM FAILURE
PEAK FLOOD TIME 192.0 HOURS 171.0 HOURS
PEAK ELEVATION 1222.3 FEET 1222.5 FEET
Wilkins Lake
Flamingo Lake
Flamingo Lake
Pemaline Lake
Public Access



N

LEGEND

AREA 16

Area of Potential Secondary Problems Stemming From Inundation. *See Table 3.*

Limit of Probable Maximum Flood Without Dam Failure

Limit of Probable Maximum Flood With Dam Failure

32 — 32 Cross Section

Corporate Limits

6000 4000 2000 0 6000

SCALE IN FEET

Contour interval 10 feet

National Geodetic vertical datum of 1929

Source of base map: U.S. Geological Survey, 7.5 minute series.

Minnewawa, Palisade, 1970

Waukenabo, 1973

NOTE: The inundated areas shown on this map reflect events of an extremely remote nature. These results are not in any way intended to reflect upon the integrity of the Sandy Lake Dam

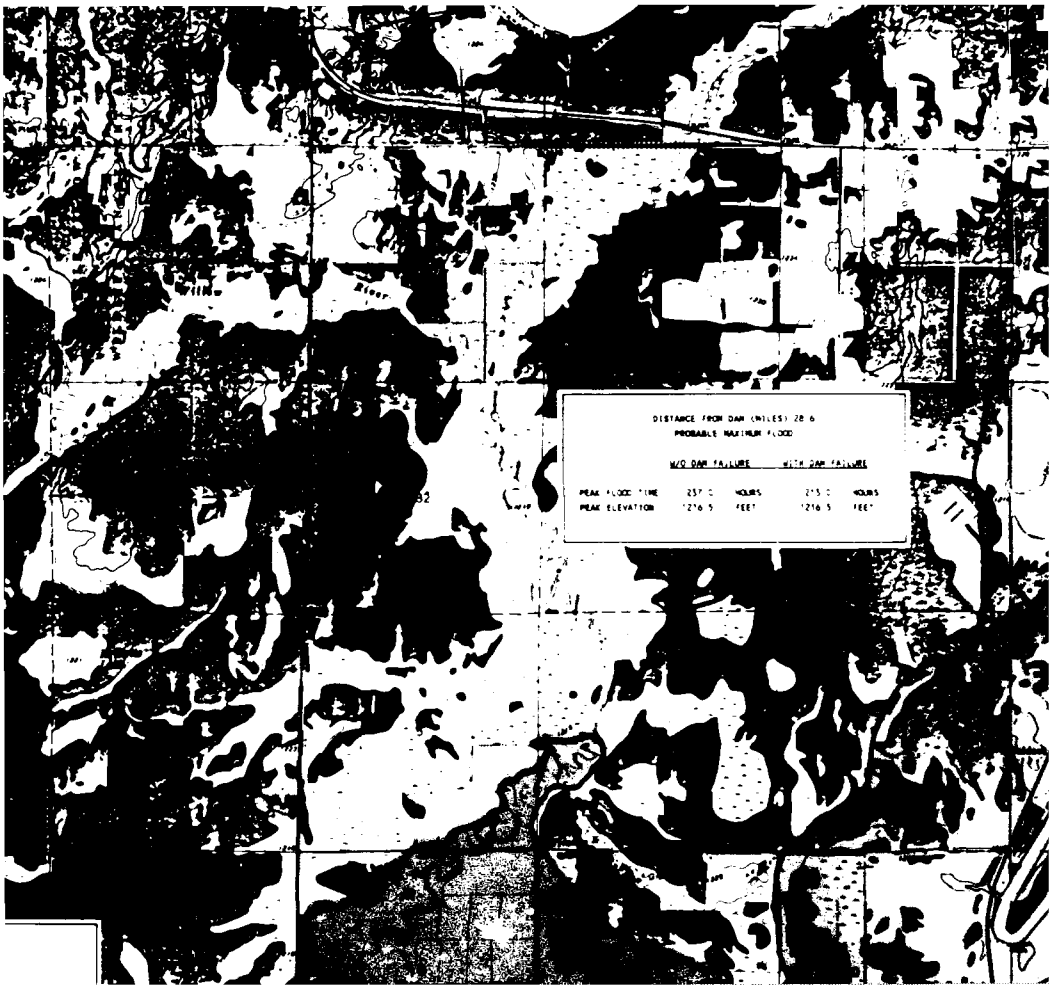
U.S. ARMY ENGINEER DISTRICT, ST. PAUL
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

SANDY LAKE DAM
EMERGENCY PLAN

INUNDATION MAP

JULY 1987

PLATE NO. 03


DISTANCE FROM DAM (MILES) 28.6
PROBABLE MAXIMUM FLOOD
W/O DAM FAILURE
WITH DAM FAILURE
PEAK FLOOD TIME 23.5 HOURS 21.5 HOURS
PEAK ELEVATION 1216.5 FEET 1216.5 FEET

N

LEGEND

AREA 16

Area of Potential Secondary Problems Stemming From Inundation See Table 3

Limit of Probable Maximum Flood Without Dam Failure

Limit of Probable Maximum Flood With Dam Failure

32 — 32 Cross Section

Corporate Limits

4000 0 2000 4000 6000

SCALE IN FEET

Contour interval 10 feet

National geodetic vertical datum of 1929

Source of base map U.S. Geological Survey 7.5 minute series, Esquagama Lake, Waukenabo, 1973

NOTE: The inundated areas shown on this map reflect events of an extremely remote nature. These results are not in any way intended to reflect upon the integrity of the Sandy Lake Dam.

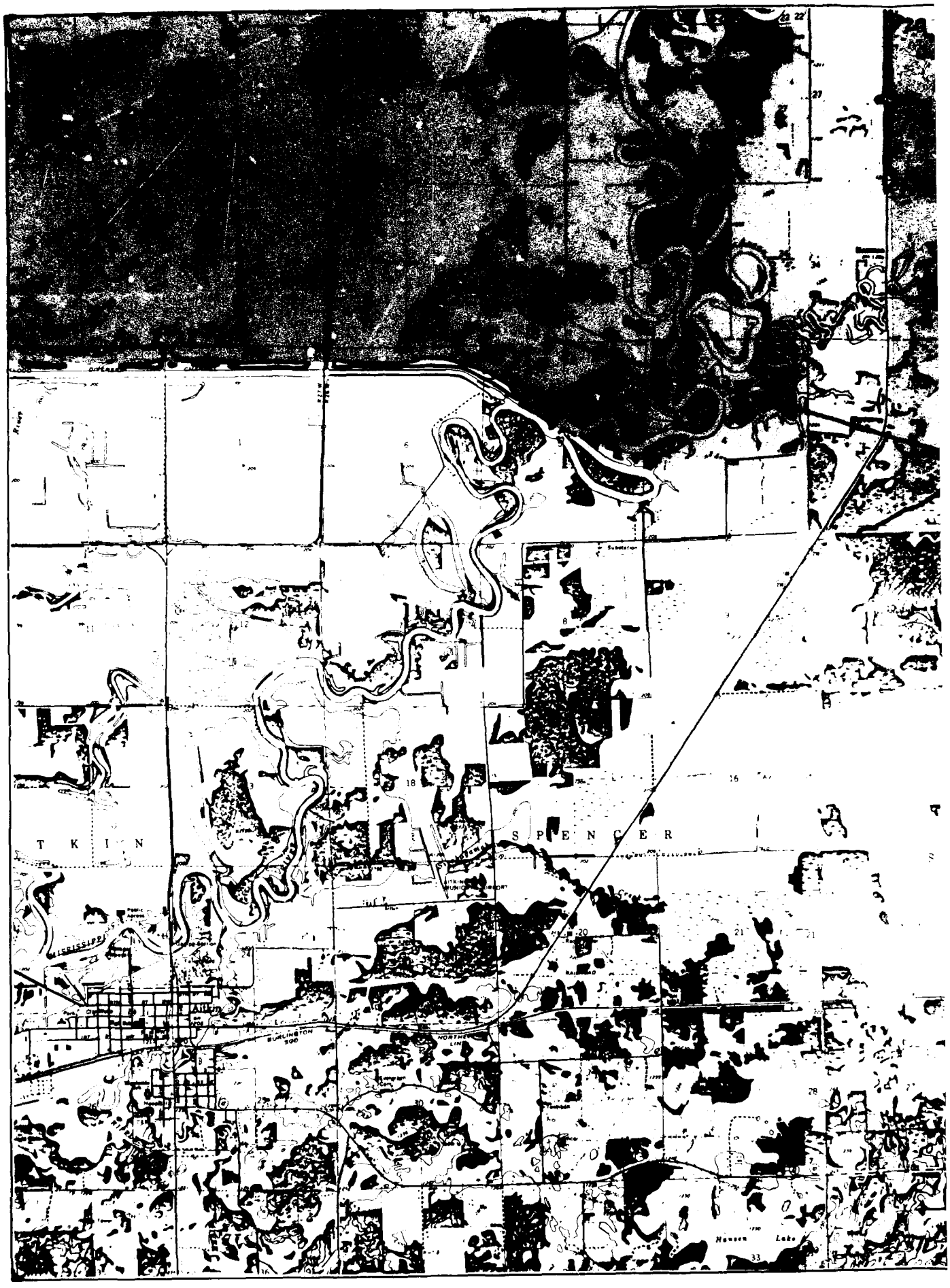
U.S. ARMY ENGINEER DISTRICT, ST. PAUL
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

SANDY LAKE DAM
EMERGENCY PLAN

INUNDATION MAP

JULY 1987

PLATE NO. D4


T K I N
S P E N C E R
Hansen
Lake

N

LEGEND

Limit of Probable Maximum Flood Without Dam Failure

Limit of Probable Maximum Flood

32 32

1000 0 2000 6000

Atkin, Hassman, 1973

NOTE: The inundated areas shown on this map reflect events of an extremely remote nature. These results are not in any way intended to reflect upon the integrity of the Sandy Lake Dam.

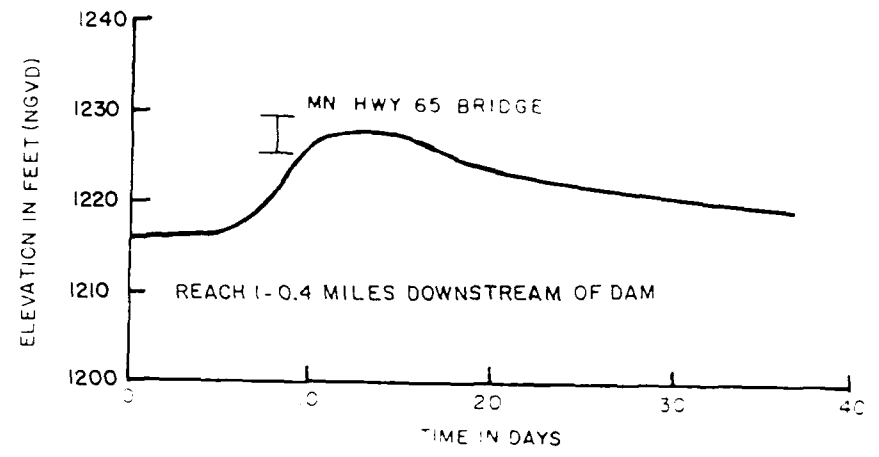
U.S. ARMY ENGINEER DISTRICT, ST. PAUL
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

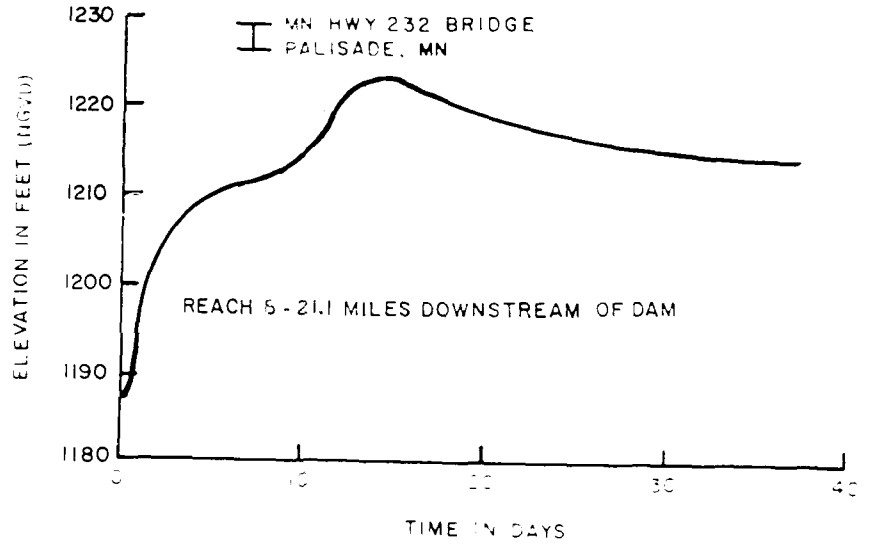
SANDY LAKE DAM
EMERGENCY PLAN

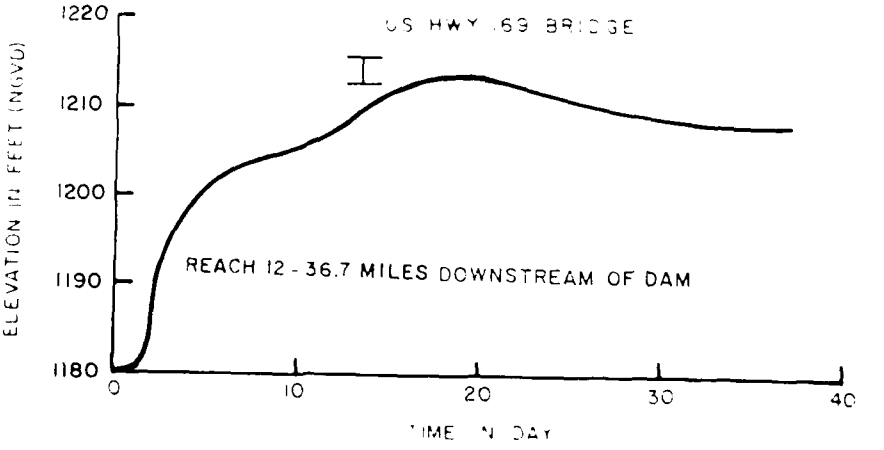
INUNDATION MAP

JULY 1987

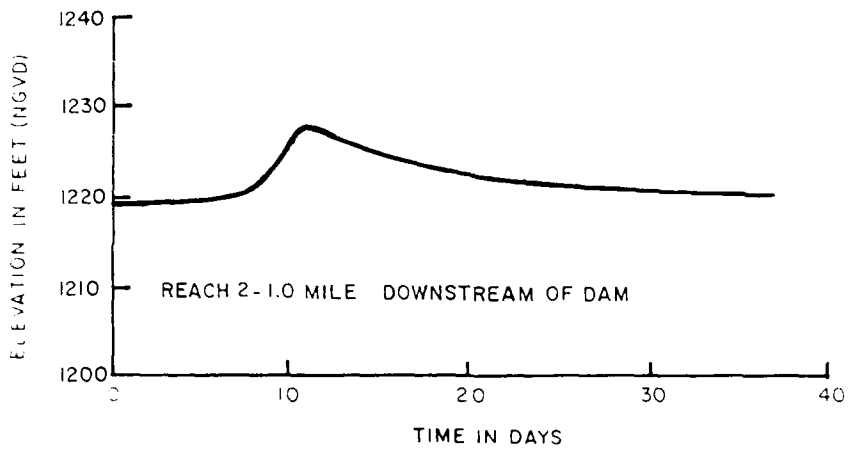
PLATE NO. 5

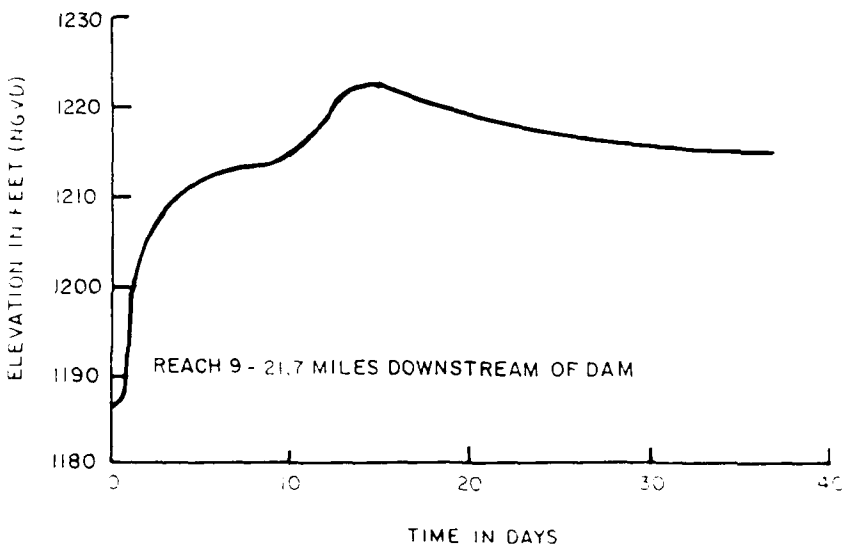


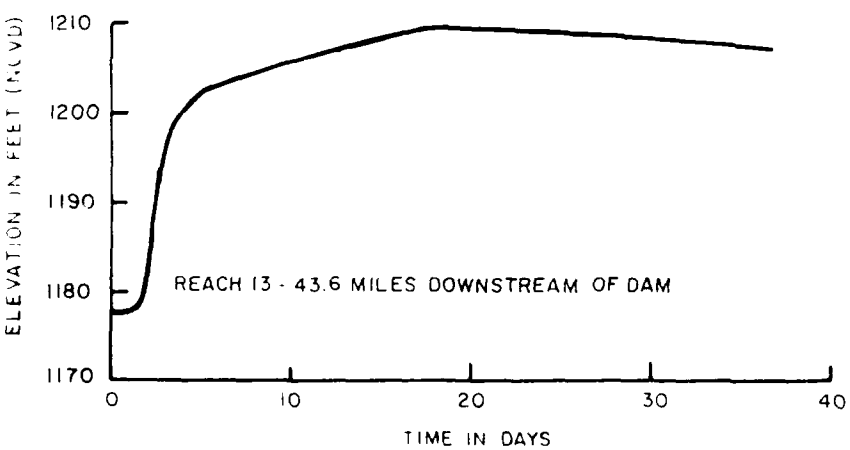




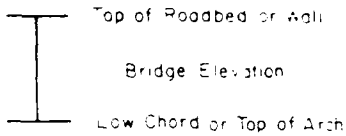
NOTE: TIME ZERO IS AT BEGINNING OF STORM







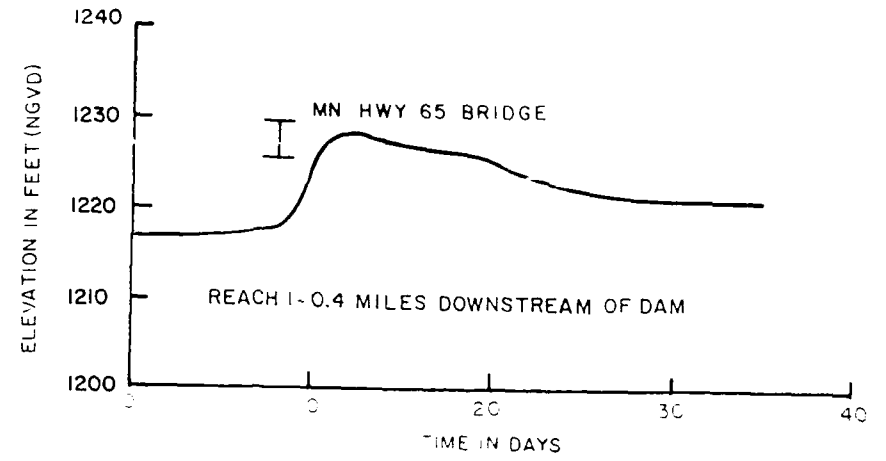
LEGEND

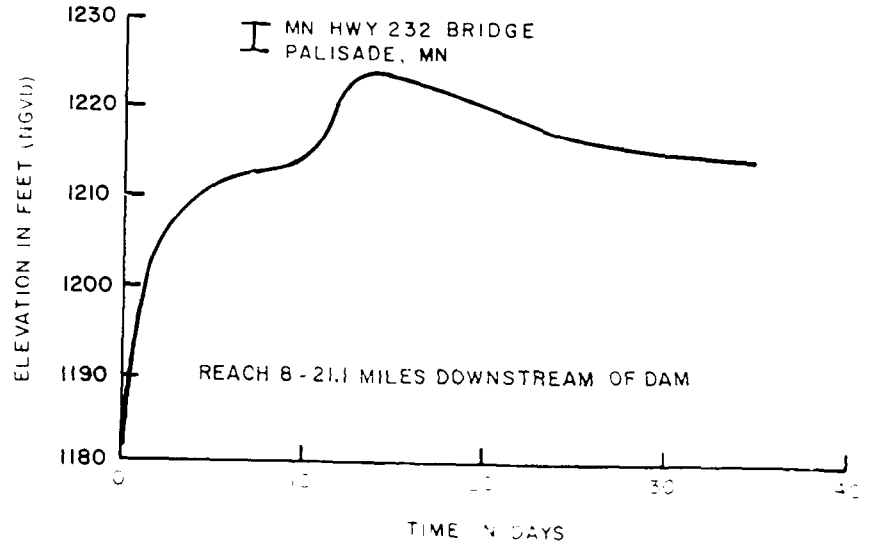


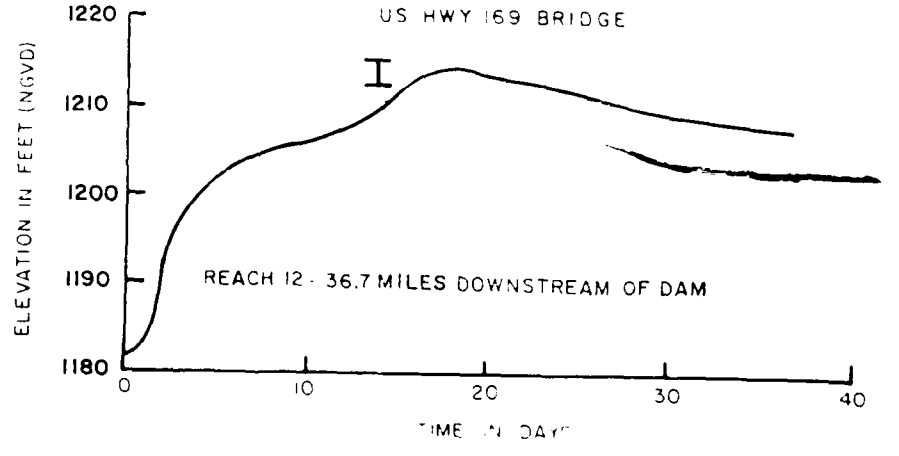
STAGE HYDROGRAPHS FOR PROBABLE MAXIMUM FLOOD WITHOUT FAILURE

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

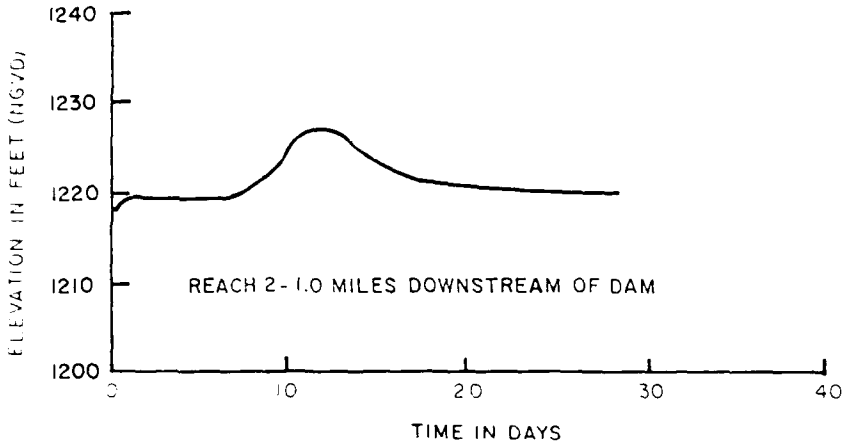
PLATE D-6

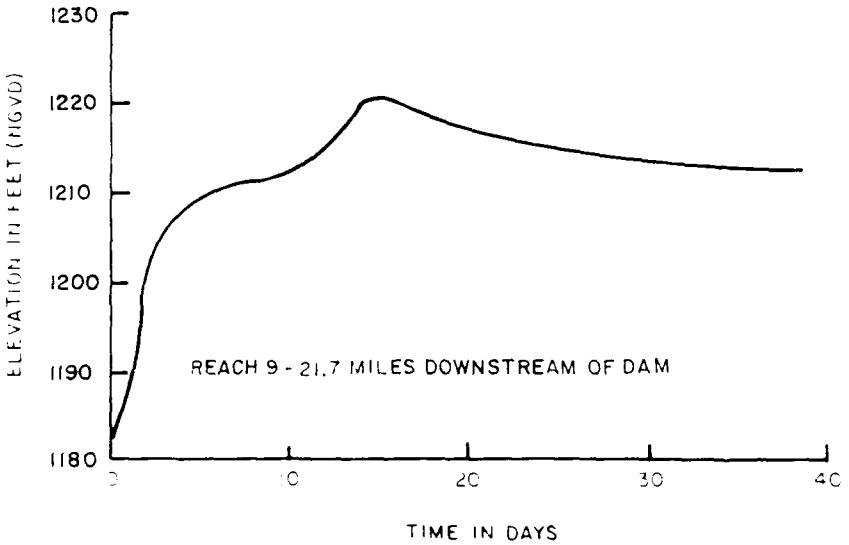


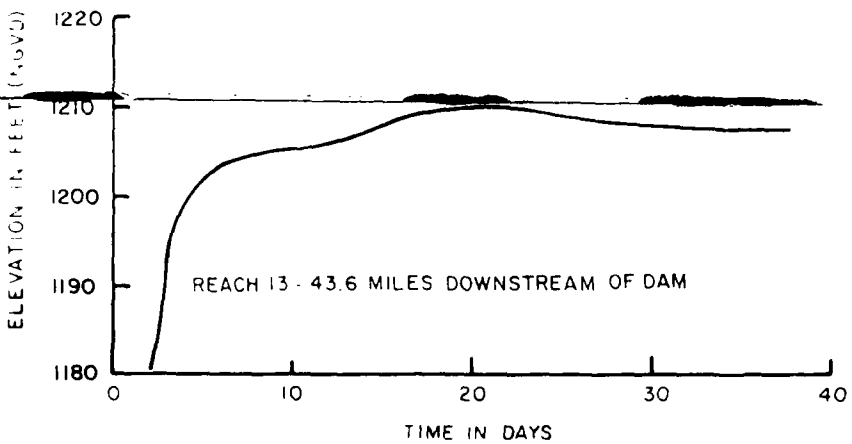




NOTE: TIME ZERO IS AT BEGINNING OF STORM.







LEGEND

Top of Roadbed or Wall

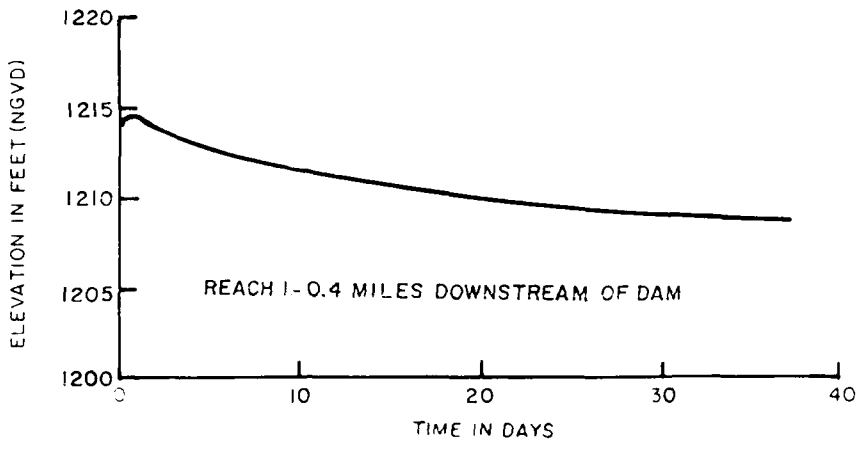
Bridge Elevation

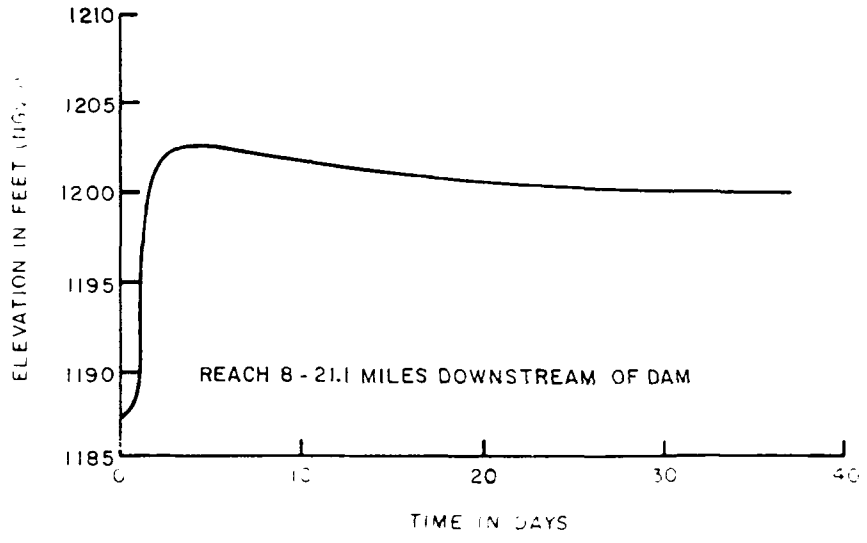
Low Chord or Top of Arch

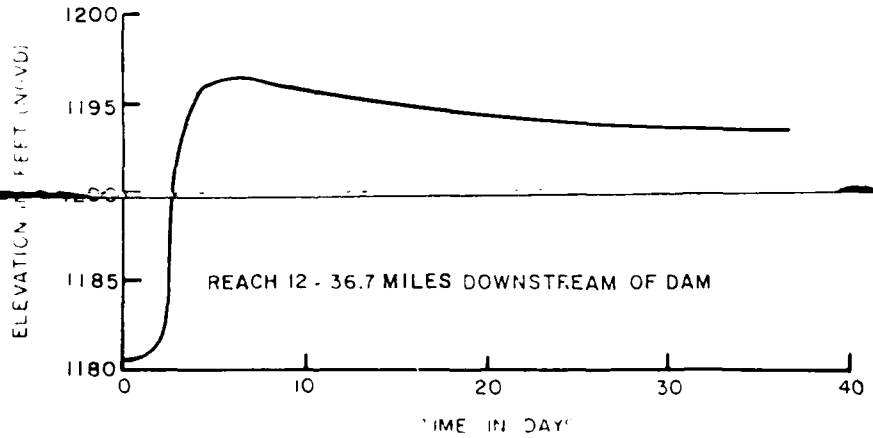
STAGE HYDROGRAPHS FOR PROBABLE MAXIMUM FLOOD WITH FAILURE

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

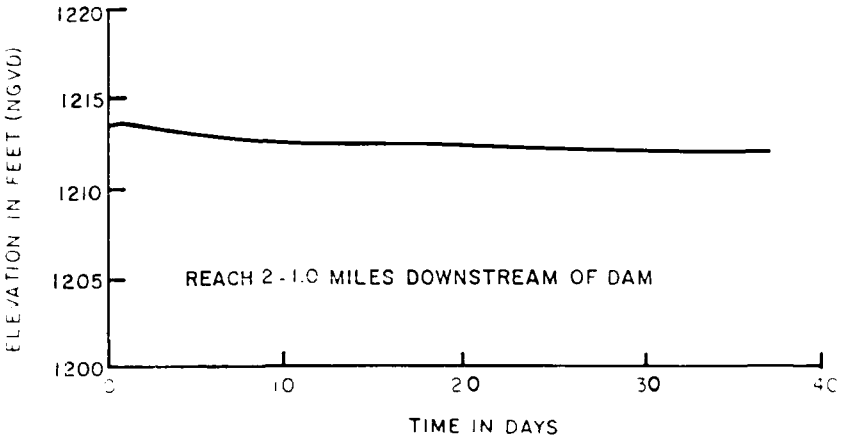
PLATE D-7

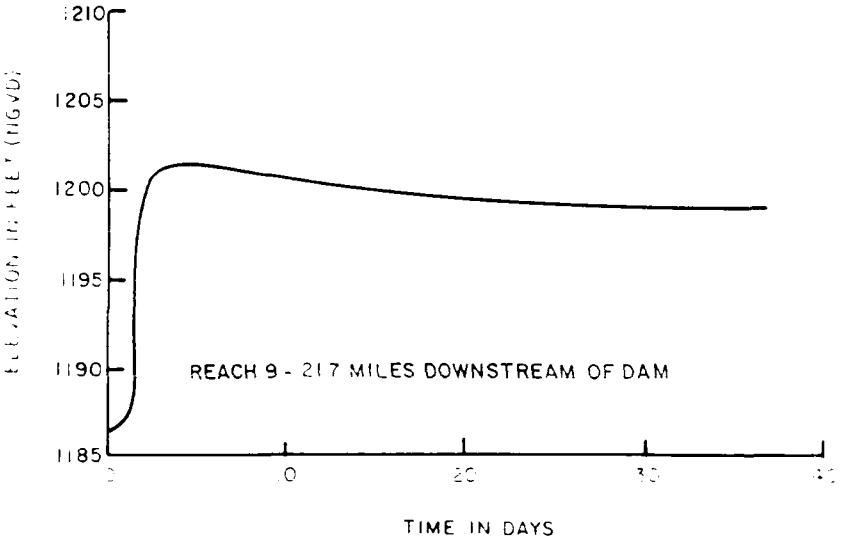


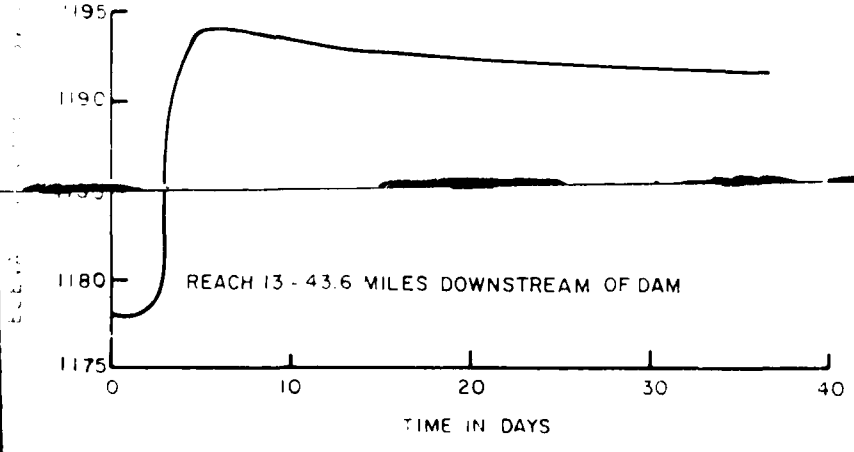




NOTE: TIME ZERO IS AT BEGINNING OF STORM.







LEGEND

Top of Roadway / Crest

Bridge Elevation

Low Chord / Top of Arch

STAGE HYDROGRAPHS FOR FAILURE AT NORMAL HIGH POOL ELEVATION

EMERGENCY PLAN
SANDY LAKE DAM
AND
RESERVOIR
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

PLATE D-8

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL	SUBJECT
CENCS-ED-M(11-2-240A)	Changes to Emergency Action Plan Sandy Lake Dam

TO	FROM	DATE	CMT 1
See Attached Distribution	CENCS-ED-M	27 September 1988 Anderson/423	

Copies of the changes to the Emergency Action Plan for Sandy Lake Dam are attached. Please insert these changes into the appropriate places in the book you already have in your possession. If you have any questions or need additional copies, feel free to call me at (612)220-0429.

John F. Blackstone

JOHN F. BLACKSTONE
Project Manager

☆ U.S. Government Printing Office: 1983—406-86

TABLE A-1
Information on Key Contacts

PARTY	TELEPHONE NUMBERS OFFICE	RESIDENCE	RADIO FREQUENCY	CALL LETTERS
DISTRICT PERSONNEL				
Park Manager				
Donald Daly	(218)426-3482	(218)426-3482	SSB	WUD632
Mississippi Headwaters Project Office				
James Ruyak	(218)566-2306	(218)566-1294	SSB	WUD639
St. Paul District Office				
Emergency Operations Center[1]				
Twenty-four (24) hour telephone service. Must be kept informed of all pre-emergency or emergency situations. Also contact for matters involving national security, disasters, mobilization or NWS flood forecasts. Center will contact Dam Safety Officer, the Commander/District Engineer and NCD.				
District Emergency Operations Center	(612)220-0208		Contact Hastings Electronic Service Center at (612)437-2210 (call letters - WUD6)	
David Christenson, Chief, Emergency Management Natural Disaster Planner	(612)220-0204 (612)725-7511	(612)690-5749		
Natural Disaster Planner	(612)220-0204			
Project Operations Branch				
Responsible for identifying a person-in-charge of the pre-emergency or emergency situation. Must be kept informed of all pre-emergency or emergency situations. Also contact for matters involving normal dam operations, and/or matters not covered by other District elements. Project Operations Branch will contact Dam Safety Officer for engineering and technical assistance and keep him informed of situation.			SSB(Primary 5040Khz) 1st Alternate-6020Khz LSB) (Emergency-5015Khz LSB)	
Dennis Erickson Chief, Natural Resource Management Section	(612)220-0325	(612)452-6850		
Thomas Oksness, Chief, Lock and Dam Section	(612)220-0322	(612)431-0272		

TABLE A-1
Information on Key Contacts

PARTY	TELEPHONE NUMBERS OFFICE	RESIDENCE	RADIO FREQUENCY	CALL LETTERS
Dave Parsons, Chief, Project Operations Branch	(612)220-0320	(612)421-2516		
Dam Safety Officer To be informed of all pre-emergency or emergency situations. Responsible for identifying and/or providing the necessary engineering or technical support required to resolve the pre-emergency or emergency situation.				
Robert Post, Chief, Engineering Division	(612)220-0303	(612)437-1316		
				LETTERS
Water Contol Center[3] For matters involving reservoir regulation.				
Edward Eaton, Water Control Center[1]	(612)220-0617	(612)731-9426		WUD613
Bonnie Montgomery, Water Control Center[1]	(612)220-0618	(612)450-0909		WUD613
Gordon Heitzman, Water Control Center[1]	(612)220-0620	(612)429-9500		
Kelsey Willis, Water Control Center[1]	(612)220-0619	(612)566-5022		
Helmer Johnson, Chief, Geotechnical, Hydraulics & Hydrologic Engineering Branch[1]	(612)220-0602	(612)633-7791		
Geotechnical Design Section[3] For matter involving the structural integrity of the dam				
Lavane Dempsey, Geotechnical Design Section	(612)220-0644	(612)633-7361		
Helmer Johnson, Chief, Geotechnical Hydraulics & Hydrologic Engineering Branch	(612)220-0602	(612)633-7791		
Design Branch[3] For matters involving the structural integrity of the outlet structures.				
Marlin Hunter, Chief, Design Engr. Section[1]	(612)220-0511	(612)784-6123		
William Westall, Chief, General Engr. Section[1]	(612)220-0512	(612)455-7632		
Robert Fletcher, Chief, Design Branch[1]	(612)220-0510	(612)484-4998		
Others[3] If none of the above can be reached.				

TABLE A-1
Information on Key Contacts

PARTY	TELEPHONE NUMBERS OFFICE	RESIDENCE	RADIO FREQUENCY	CALL LETTERS
(continued)				
Chief, Project Management Br.[2]	(612)220-0444			
Wayne Knott, Chief, Environmental Resources Br.[2]	(612)220-0400	(612)739-2724		
Louis Kowalski, Chief, Planning Division[2]	(612)220-0307	(612)457-6453		
Ltc. David Nelson, Deputy Commander[2]	(612)220-0301	(715)247-5661		
Col. Roger L. Baldwin[2]	(612)220-0300	(		
Aitkin County				
Civil Defense Director	(218)547-3300	(218)335-6191		
Sheriff	(218)297-2138			
MN State Patrol[4]	(612)482-4901			

1 Call personnel in order listed until contact is made.
2 To be called in the order listed.
3 To be contacted if no contact can be made with other elements.
4 Potential Sources of Assistance in Communication.

TABLE C-1
NOTIFICATION LIST FOR CORPS OF ENGINEERS OFFICES (INTERNAL)

OBSERVER

1. Observer potential dam problem.
2. Gather pertinent facts to describe situation.
3. Assess whether slowly developing, rapidly developing or imminent failure.
4. Notify first available dam supervisor in order shown.

(If contact cannot be made with Dam Supervisor listed below then contacts should be made in this order: Area Project Office, Dam Safety Officer, Project Operations Branch, or Emergency Operations Center as shown on the attached list.)

DAM SUPERVISOR

	Office	Home Phone	Radio
*Donald Daly	(218)426-3482	(218)426-3482	SSB/FM WUD632
Terry Ladd	(218)426-3482	(218)845-2921	SSB/FM WUD632

1. Assess observer's report.
2. Take necessary emergency actions.
3. Notify Area Project Office, Dam Safety Officer, Project Operations Branch, or Emergency Operations Center.

AREA PROJECT OFFICE

	Office	Home Phone	Radio
James Ruyak	(218)566-2306	(218)566-1294	SSB/FM WUD639

1. Assess the situtation.
2. Take necessary emergency actions.
3. Notify Dam Safety Officer, Project Operations Branch, or Emergency Operations Center.

2 of 4 3 of 4 4 of 4
(REFER TO SHEETS)

TABLE C-1
NOTIFICATION LIST
FOR CORPS OF ENGINEERS
OFFICES (INTERNAL)

PROJECT OPERATIONS BRANCH

	Office	Home Phone
Dennis Cin	(612)220-0320	(612)455-6786
Thomas Oksness	(612)220-0322	(612)439-0272
Dennis Erickson	(612)220-0325	(612)452-6850

Responsible for identifying a person-in-charge of the pre-emergency or emergency situation. Must be kept informed of all pre-emergency or emergency situations. Also contact for matters involving normal dam operations, and/or matters not covered by other District elements. Project Operations Branch will contact Dam Safety Officer for engineering and technical assistance and keep him informed of situation.

OTHER DISTRICT PERSONNEL

Office	Office	Home Phone	Radio	
Western Flood Control Office				
Timothy Bertschi	(701)232-1894	(701)232-5967	FM	WUD 642
Headwaters Project Office				
James Ruyak	(218)566-2306	(218)566-1294	FM	WUD 639
Mississippi River Project Office				
Richard Otto	(507)895-6341	(507)895-6224	FM	WUD 645
Resource Managers				
Eau Galle/ Mathiesen	(715)778-5562	(715)778-4597	FM/SSB	WUD 643
Homme/ Odegaard	(701)845-2970	(701)845-2982	FM/SSB	WUD 636
Baldhill/ Odegaard	(701)845-2970	(701)845-2982	FM/SSB	WUD 636
Lk. Traverse/ Salberg	(612)563-4586	(612)563-4586	FM/SSB	WUD 638
Orwell/ O'Neel	(218)736-6463	(612)736-6463	FM/SSB	WUD 638
Lac Qui Parle/ Hanson	(612)269-6303	(612)269-9632	FM/SSB	WUD 630
Sandy/ Daly	(218)426-3482	(218)426-3482	FM/SSB	WUD 632
Pokegama/Kleinert	(218)326-6128	(218)327-2573	FM/SSB	WUD 633
Leech Lake/ Zahalka	(218)654-3145	(218)566-1642	FM/SSB	WUD 634
Pine River/Hermerding	(218)692-4488	(218)692-2118	FM/SSB	WUD 640
Winnibigoshish/Dickson	(218)246-8107	(218)566-2952	FM/SSB	WUD 631
Gull Lake/ Struss	(218)829-3334	(218)327-1060	FM/SSB	WUD 635

TABLE C-1

NOTIFICATION LIST FOR CORPS OF ENGINEERS OFFICES (INTERNAL)

DAM SAFETY OFFICER*

	Office	Home Phone
Robert Post	(612)220-0303	(612)437-1316
William Goetz	(612)220-0310	(612)454-3722
Stan Kumpula	(612)220-0304	(612)484-8957

To be informed of all pre-emergency or emergency situations. responsible for identifying and/or providing the necessary engineering or technical support required to resolve the pre-emergency or emergency situation.

DAM SAFETY COMMITTEE

	Office	Home Phone
William Goetz	(612)220-0310	(612)454-3722
Helmer Johnson	(612)220-0602	(612)633-7791
Robert Engelstad	(612)220-0610	(612)459-6343
Robert Fletcher	(612)220-0510	(612)484-4998
Dennis Cin	(612)220-0320	(612)455-6786
Dale Mazar	(612)220-0444	(612)631-1940
Stan Kumpula	(612)220-0304	(612)484-8957

NCD DAM SAFETY OFFICER*

	Office	Home Phone
Zane Goodwin*	(312)353-6311	(312)823-4606
Carl Cable	(312)353-6372	(312)357-4529
Don Leonard	(312)353-6355	(312)359-3372
Lee Hoglind	(312)353-6358	(312)579-0148

OCE DAM SAFETY OFFICER*

	Office	Home Phone
Lloyd Duscha*	(202)272-0382	(703)860-1319
William McCormick	(202)272-0397	(703)569-4323
John McPherson	(202)272-0215	(703)659-2650
Edward Prickett	(202)272-0207	(301)865-5876
Robert Smith	(202)272-0220	(703)569-3128
Earl Eiker	(202)272-8500	(301)465-2120
John Elmore	(202)272-0196	(703)339-8279

TABLE C-1
NOTIFICATION LIST FOR CORPS OF ENGINEERS OFFICES (INTERNAL)

EMERGENCY OPERATIONS CENTER

	Office	Home Phone
District EOC	(612)220-0208	(24-hr. Number)
David Christenson	(612)220-0204	(612)690-5749

Twenty-four (24) hour telephone service. Must be kept informed of all pre-emergency or emergency situations. Also contact for matters involving national security, disasters, mobilization or NWR flood forecasts. Center will contact Dam Safety Officer, the Commander/District Engineer and NCD.

DISTRICT ENGINEER

	Office	Home Phone
Col. Roger L. Baldwin	(612)220-0300	(612)894-6410

PUBLIC AFFAIRS OFFICE

	Office	Home Phone
Kennon Gardner	(612)220-0201	(612)884-9023
24-Hr. Answer Machine	(612)220-0200	

NCD EMERGENCY MANAGER

	Office	Home Phone
Natural Disaster Planner Bernard Bochantin	(312)353-5275	(815)568-7544
Chief Emergency Management Tim Monteen	(312)886-8451	(312)961-2195

DISTRICT RADIO

Contact Electronic Service Center at	(612)437-2210	WUD6
SSB Primary		5400Khz
1st Alternate		6020Khz
Emergency		5015KhzLSB

For additional information see Appendix CNCS 500-1-1.